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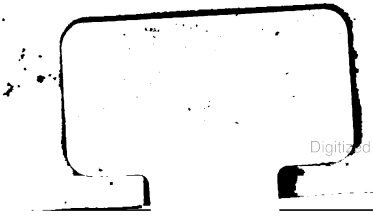
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TRANSACTIONS

OF THE

WOOLHOPE

NATURALISTS' FIELD CLUB.

(ESTABLISHED MDCCCLI.)

INCLUDING THE FIRST PART OF

THE FLORA OF HEREFORDSHIRE,

BY THE REV. W. H. PURCHAS, L. Th.

1866.

"HOPE ON - HOPE EVER."

Hereford:

PRINTED BY WILLIAM PHILLIPS, HIGH TOWN,
AND AT THE TIMES OFFICE, MAYLORD STREET.

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A

FLORA OF HEREFORDSHIRE.

PART I.

BY THE REV. W. H. PURCHAS, L. Th.

HONORARY MEMBER OF THE WOOLHOPE NATURALISTS' FIELD CLUB.

Hereford:

PRINTED BY WILLIAM PHILLIPS, HIGH TOWN,

FOR THE WOOLHOPE NATURALISTS' FIELD CLUB.

1867.

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ADVERTISEMENT.

After lengthened delays, the first portion of the "FLORA OF HEREFORDSHIRE" is here presented to the Members of the Woolhope Club.

This portion will be found to consist of—First, an account of the Botanical Districts into which it has been found necessary to sub-divide the County; Second, Geological Notes on each of these districts, from the able pen of the REV. W. S. SYMONDS, F.G.S., Rector of Pendock; Third, a Map of the County, illustrating these divisions; and Fourth, a Tabular Summary of the plants hitherto found in each district.

It has of late years been felt that a very imperfect view of the botany of any county was given by the plan on which the older local Floras were drawn up; that plan being to mention Stations for the rarer plants, or those supposed to be such, whilst it was left to be inferred that the remainder were equally common throughout the whole area to which the Flora related. The real truth being that species, which from their frequency in one part of a county, might be expected to prevail equally throughout its whole extent, are found, when specially sought after, to be comparatively local. Nor on the older plan was any distinction shewn between those parts of the County which had been fully examined, and those which had received little or no attention. The plan of sub-dividing* the county and forming separate catalogues of plants for each district obviates this, and shews, at one view, what has been done, and how much remains to be accomplished.

---

* This plan was first adopted by my acute and deeply lamented friend, the REV. W. H. COLEMAN, one of the Authors of the "FLORA HERTFORDIENSIS."

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As this first portion of the "FLORA OF HEREFORDSHIRE" supplies a condensed view of the results hitherto attained, it has been thought better to issue it at once, rather than to delay its appearance until the remaining portion of the work shall have been printed. The latter will consist of a more detailed mention of the different plants, specifying their localities when desirable, and giving any further information that may seem needful. In that portion of the work I hope to mention by name the many kind and able correspondents who have aided me with their observations. At present I must content myself with a brief and general expression of thanks for their invaluable assistance. I hope this first instalment of the work will prove to them that their labours have not been vainly bestowed, and that it will stimulate them to further exertions in the same field. I shall be glad to hear of any additions they may make to the different district lists, and to be informed of any inaccuracies they may detect. It is very desirable to confirm the accuracy of any new locality, by sending a specimen of the plant whenever practicable.

W. H. PURCHAS.

Gloucester, April, 1867.

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APPENDIX No. 1.

SUMMARY

OF THE

GEOGRAPHICAL DISTRIBUTION OF PLANTS

IN HEREFORDSHIRE.

	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	LACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Clematis Vitalba, Linn.	1	2	3	4		6		8	9	10		12?		14
Thalictrum flavum, L.		2	3				7	8						
Anemone nemorosa, L.	1	2	3	4		6	7	8	9	10		12		14
(Myosurus minimus, L.)										?				
Ranunculus heterophyllus, Fr.	1	2	3	4			?	8	9	10	11	12		14
——— Drouettii, Bab. ..		?						8						
——— trichophyllus, Fr.								?						
——— circinatus, Sibth.							7			10				
——— fluitans, Lam. ...	*	2					7	8	9			?		
——— hederaceus, L. ...	1	2	3	4			7	8	9	10		12		14
——— Ficaria, L.	1	2	3	4		6	7	8	9	10		12		14
——— Flammula, L. ...	1	2	3	4		6	7	8	9	10		12		14
——— Lingua, L.													13	
——— auricomus, L. ...	1	2	3	4		6	7	8	9	10		12		14
——— acris, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— repens, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— bulbosus, L.	1	2	3	4		6	7	8	9	10		12		14
——— hirsutus, Curt. ...	1		3			6		8	9	10		12	13	14
——— sceleratus, L.		2		4		6	7	8	9	10			13	14
——— parviflorus, L. ...		2	3	4			7	8		10			13	
——— arvensis, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
Caltha palustris, L.	1	2	3	4		6	7	8	9	10		12		14
*Trollius europœus, L.								8					13	14
Helleborus viridis, L.....		2	3		5	6		8	9					14
——— fœtidus, L.		2	3				7							
Aquilegia vulgaris, L.	1	2	3	4				8	9					
Aconitum Napellus, L.		2							9					
*Berberis vulgaris, L.		2	3				7	8	9			12		
Nuphar lutea, Sm.				4			7	8						

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	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	ARMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Papaver Argemone, L.		2	3	4					9					
——— dubium, L.		2		4					9		11	12		
——— Rheas, L.	1	2	3	4		6	7	8	9	10		12		14
——— *somniferum*													*	
*Chelidonium majus, L.	1	2	3	4		6	7	8	9	10		12	13	14
Corydalis claviculata, D.C....				4										
——— lutea, D.C.	*						*							
Fumaria capreolata, L	1	2	3	4		6	7	8	9	10		12		
——— officinalis, L.	1	2	3	4		6	7	8	9	10	11	12		14
——— micrantha, Lag.....							7							
Coronopus Ruelli, Gaertn. ..		2		4			7	8	9					
Thlaspi arvense, L.	1	2	3	4		6								
Capsella Bursa pastoris, D.C.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hutchinsia petræa, Br.		2												
Lepidium Smithii, Hook. ...	1						7			10	11	12		
——— campestre, Br.....	1	2	3	4					9	10		12	13	14
Armoracia rusticana, Baumg.		*		4			7							
Draba verna, L.	1	2	3	4			7	8	9			12		14
Camelina sativa, Crantz. ...	*					*								
Cardamine pratensis, L.	1	2	3	4		6	7	8	9	10		12		14
——— hirsuta, L.	1	2	3	4		6	7	8	9		11	12		14
——— sylvatica, Link..	1	2					7		9	10		12		
——— impatiens, L.....	1	2										12		
Arabis thaliana, L.	1	2	3	4		6	7		9	10	11	12		14
——— hirsuta, Br.		2					7			10		12		14
Barbarea vulgaris, Br....	1	2	3	4		6	7		9	10		12		
——— stricta, Andrz.		2												
Nasturtium officinale, Br. ...	1	2	3			6	7	8	9	10		12		14
——— terrestre, Br.....		2							9	10		12		
——— sylvestre, Br. ...		2	3			6	7						13	
——— amphibium, Br...		2	3											
Sisymbrium officinale, Scop.		2	3	4		6			9	10	11	12		14
——— Sophia, L.		†	3							10		12		
Erysimum cheiranthoides, L.	1	†								†				
——— alliaria, L.	1	2	3	4		6	7	8	9	10	11	12		14
Cheiranthus cheiri, L.....		*				6	*			*		*		
Brassica campestris, L.....		2		4					9					
Sinapis arvensis, L.....	1	2	3	4		6	7		9	10		12		14
——— alba, L.		2	3					8	9					
——— nigra, L.....	1	2	3	4	5			8	9	10		12		14
"——— tenuifolia," L.										?				
Raphanus Raphanistrum, L.	1	2			5				9					

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Reseda luteola, L.	1	2	3	4		6	7	8	9	10		12		
Helianthemum, vulgare, Gaertn.	1	2	3	4		6		8	9					
Viola odorata, L.	1	2	3	4		6	7	8	9	10		12		14
—— variety imberbis		2	3	4				8		10				
—— hirta, L.	1	2	3	4				8	9					
—— sylvatica, Fries.	1	2	3	4	5	6	7	8	9	10	11			14
—— canina, L.		2		4				8				12		
—— Tricolor, L.		2	3	4		6	7		9	10		12		14
"—— lutea," L. ?										?				
Drosera rotundifolia, L.		2		4										
Polygala vulgaris, L.	1	2	3	4		6		8	9	10	11	12		14
Dianthus Armeria, L.		2	3	4			7							
"—— deltoides," L.										?				
Saponaria officinalis, L.	1	2	3				7	8	9			12	13	
Silene inflata, Sm.	1	2	3	4		6	7		9	10	11		13	14
—— anglica, L.	1	2												
—— noctiflora, L.		2												
Lychnis Floscuculi, L.	1	2	3	4		6	7	8	9	10		12		14
—— diurna, Sibth.		2	3	4		6	7	8	9	10	11	12		14
—— vespertina, Sibth.	1	2	3	4			7	8	9	10		12		
—— Githago, Lam.	1	2	3	4		6	7	8	9	10	11	12		14
Mœnchia erecta, Sm.			3	4							11			
Sagina procumbens, L.	1	2	3	4	5		7	8	9	10	11	12		14
—— apetala, L.	1	2	3	4	5		7	8	9	10	11	12		14
—— nodosa, Mey.		2		4								12		
Spergula arvensis, L.	1	2	3	4		6	7	8	9	10	11	12		
Spergularia rubra, St. Hil.				4							11			
Arenaria scrpyllifolia, L.	1	2	3	4			7	8	9	10		12		14
—— trinervis, L.	1	2	3	4			7		9		11	12		14
—— verna, L.										?				
Stellaria nemorum, L.							?						13	
—— media, With.	1	2	3	4		6	7	8	9	10	11	12		14
—— Holostea, L.	1	2	3	4		6	7	8	9	10	11	12		14
—— graminea, L.	1	2		4		6	7	8	9	10	11	12		14
—— uliginosa, Murr.	1	2	3	4		6	7			10		12	13	
Cerastium aquaticum, L.	1	2	3	4		6	7	8	9	10		12		14
—— glomeratum, Thuill.	1	2	3	4				8	9	10	11	12		14
—— triviale, Link.	1	2		4			7	8	9	10				
—— semidecandrum, L.		2	3	4										
—— tetrandrum, Curt.		2												
—— arvense, L.												12		
Linum usitatissimum, L.	*	*											*	

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Linum catharticum, L.	1	2	3	4	5	6	7	8	9	10				14
Malva moschata, L.	1	2	3	4		6	7		9	10	11	12		14
—— sylvestris, L.	1	2	3	4		6	7		9	10	11	12		14
—— rotundifolia, L.	1	2	3	4			7	8	9	10	11	12		14
Tilia parvifolia, Ehrl.	1	2	3	4	5					10			13	14
—— *intermedia, D.C.*		*	*						*	*		*		
—— grandifolia, Ehrl.		2		†						†				
Hypericum androsæmum, L.	1	2	3	4	5		7	8	9	?			13	
—— perforatum, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
—— dubium, Leers.	1	2	3	4	5	6	7	8		10	11	12	13	14
—— quadrangulum, L.	1	2	3	4	5			8	9	10		12		14
—— humifusum, L.	1	2	3	4		6		8	9	10	11	12	13	14
—— pulchrum, L.	1	2	3	4		6	7	8	9	10	11	12	13	14
—— hirsutum, L.	1	2	3	4				8	9	10	11	12		14
—— montanum, L.	1	2	3			6	7							
—— elodes, L.											11			
—— *calycinum, L.*						*		*						
Acer campestre, L.	1	2	3	4				8	9	10				14
—— *Pseudoplatanus, L.*	*	*			*				*	*		*		
Erodium maritimum, Sm.		2												
—— cicutarium, Sm.	1	2	3	4										
—— moschatum, Sm.	1	†	3				7						13	
*Geranium Phæum, L.	†	†		†			†							
—— pratense, L.	1	2	3				7	8	9	10				14
—— pyrenaicum, L.							7							
—— pusillum, L.		2	3			6						12		
—— molle, L.	1	2	3	4		6	7	8	9	10		12		14
—— dissectum, L.	1	2	3	4		6	7	8	9	10		12	13	14
—— columbinum, L.	1	2	3	4				8		10			13	
—— lucidum, L.	1	2	3					8	9	10			13	14
—— robertianum, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
—— sanguineum, L.		2					?	8		?				
Oxalis Acetosella, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Enonymus europæus, L.		2		4	5			8	9	10				
Rhamnus catharticus, L.		2	3						9			12		
—— Frangula, L.		2	3					8						
Spartium scoparium, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
Ulex europæus, L.	1	2	3			6	7	8	9	10		12		14
—— nanus var. Gallii, Planch	1	2	3	4					9	10	11	12	13	
Genista tinctoria, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
—— anglica, L.				4					9			12	13	

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ononis arvensis, L.	1	2	3		5	6	7	8	9	10		12		14
——— antiquorum, L.	1		3						9	10				
Anthyllis vulneraria, L.		2		4					9					
Medicago lupulina, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
* ——— denticulata, Willd.		*												
Melilotus officinalis, Willd.			3	4		6			9	10				
* ——— arvensis, Wallr.		*							†	*				
Trifolium repens, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— pratense, L.	1	2	3	4	5	6	7	8	9	10		12		14
——— medium, L.	1	2	3	4				8	9	10	11	12		14
——— arvense, L.	1	2		4					9					14
——— striatum, L.		2	3	4			7			10				
——— fragiferum, L.		2	3	4			7							
——— procumbens, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— minus, Reth.	1	2		4		6		8	9	10	11	12		
——— filiforme, L.		2		4										
Lotus corniculatus, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
—— tenuis, W. & N.			3						9					
—— major, Scop.	1	2	3	4		6	7	8	9	10	11	12	13	14
Astragalus glyciphyllos, L.			3	4		6	7	8						
Ornithopus perpusillus, L.		2		4						10				
Hippocrepis comosa, Linn.		2		?										
Onobrychis sativa, Lam.		2		4					9					
Vicia sylvatica, Linn.		2	3	4	5	6	7	8	9	10		12	13	
—— Cracca, L.		2	3	4			7	8	9	10		12	13	14
—— *Sativa, L.*			†	†			†		†				†	†
—— Bobartii, Forst.		2	3	4		6	7		9			12		
—— sepium, L.	1	2	3	4		6	7	8	9	10		12	13	14
—— hirsuta, Koch.	1	2	3	4					9	10		12	13	14
—— tetrasperma, Koch.	1	2	3	4		6	7	8	9	10		12	13	14
("Lathyrus latifolius") ?							?							
Lathyrus pratensis, L.		2	3	4	5	6	7	8	9	10		12		14
——— sylvestris, L.			3	4			7	8	9	?	11			
Orobus tuberosus, L.		2	3	4	5	6	7	8	9	10		12	13	14
Var. tenuifolius		2								10				
Prunus spinosa, L.	1	2		4	5		7	8		10				14
——— insititia, L.		2												
* ——— domestica, L.		†												
——— Padus, L.	1				5				9			12		
* ——— Cerasus, L.		†												
——— avium, L.	1	2	3	4		6	7	8		10				

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Spiræa Ulmaria, L.	1	2	3		5	6	7	8	9	10		12	13	14
——— Filipendula, L.		2												
Geum urbanum, L.	1	2	3	4		6	7	8	9	10		12	13	14
—— var intermedium, Ehrh.					5									
—— rivale, L.					5					?				
Agrimonia Eupatoria, L.	1	2	3	4	5	6		8	9	10		12	13	14
—— —— odorata, Mill.	1												?	
Potentilla anserina, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— argentea, L.	1	2	3				7			10			13	14
——— verna, L.			3	4						?				
——— reptans, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— Tormentilla, Schk.		2	3	4		6	7	8	9	10		12		14
——— nemoralis, Nestl.	1		3						9				13	
——— Fragariastrum, Ehrh	1	2	3	4		6	7	8		10				14
Comarum palustre, L.										10	11	12	13	
Fragaria vesca, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— elatior, Ehrh.								8	9					
Rubus Idæus, L.	1	2	3	4		6		8		10		12	13	14
—— plicatus, W. & N.				4										
—— nitidus, Bell. Salt.	1	2		4										
—— rhamnifolius, W. & N.	1	2		4										
—— thyrsoideus, Wimm.	1													
—— discolor, W. & N.	1	2		4		?								
—— leucostachys, Sm.	1	2	3	4										
—— carpinifolius, W. & N.		2		4										
—— pampinosus, Lees.	1			4										
—— macrophyllus, W. & N.				4										
—— Hystrix, Weihe.	1	2		4										
—— rudis, Weihe.	1	2		4										
—— pallidus, Weihe.	1			4										
—— Kœhleri, Weihe.	1	2		4										
—— fuscoater, Weihe.	1			4			7							
—— glandulosus														
—— var. Bellardi, Weihe.				4										
—— var. fuscus, Bab.	1			4										
—— var. Lejeunii, Weihe.				4										
—— var. rosaceus, Weihe.		2												
—— Balfourianus, Blox.	1													
—— corylifolius, Sm.	1	2												
—— nemorosus, Hayne	1			?										
—— cœsius, L.	1	2		4				8	9	10				

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Rubus althæifolius, Host.....		2												
Rosa spinosissima, L.									9					
—— Doniana, Woods.....				4										
—— tomentosa, L.	1	2	3	4	5	?	7		9			12		14
—— villosa, L.....				4		?	?							
—— micrantha, Sm.....		2		4		?	7		9					
—— rubiginosa, L. ?	?			?		?		?						
—— canina, L.....		2		4	5	6	7		9	10	11	12	13	14
—— b. sarmentacea, Woods.				4										
—— c. surculosa, Woods. ...	1	2												
—— d. dumetorum, Woods.		2							9					
—— e. Forsteri, Smith		2		4										
—— systyla, Aut.....				4										
—— arvensis, L.		2	3	4	5	6	7	8	9	10	11	12		
Sanguisorba officinalis, L.....		2	3				7	8		10			13	14
Poterium sanguisorba, L.		2	3	4		6		8	9					
——— muricatum, Spach....		2												
Alchemilla vulgaris, L.....	1	2	3	4		6	7	8	9	10		12	13	14
——— arvensis, Lam. ...		2	3	4		6	7	8	9	10	11	12		14
Cratægus oxyacantha, L.	1	2	3	4		6	7	8	9	10	11	12		14
Pyrus communis, L.		2		4			*		9					
—— malus, L.....		2	3	4		6	7	8	9	10				14
—— torminalis, Sm.		2	3	4				8	9					
—— Aria, Sm.		2												
—— scandica, Bab.....		2												
—— aucuparia, Gaertn.		2	3	4		6			9	10	11	12		14
Epilobium augustifolium	1	2	3			6								
——— hirsutum, L.....		2	3	4	5	6	7	8	9	10		12		14
——— parviflorum, Schreb.	1	2	3		5	6	7	8	9	10	11			
——— montanum, L.	1	2	3	4	5	6	7	8	9		11	12		14
——— roseum, Schreb. ...		2	3			6	7		9	10	11	12		
——— palustre, L.	1			4					9		11	12		
——— tetragonum, L.....		2												
——— obscurum, Shreb....	1	2		4		?		8	9	10	11	12		
Circæa lutetiana, L.		2	3	4	5	6	7	8	9	10	11	12		14
Œnothera biennis, L.		+					+		+					
Hippuris vulgaris, L.	1											12	13	
Myriophyllum verticillatum, L.			3				7							
——— spicatum, L. ...		2	3				7	8	9					
Callitriche verna, L.		2	3	4	5		7	8	9	10		12	13	14
——— platycarpa, Kütz....	1													

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Callitriche pedunculata, var. sessilis, Bab.		2												
——— autumnalis, L. ? ..												?	?	
Ceratophyllum demersum, L.		2											13	
Lythrum salicaria, L.		2	3				7	8	9			12		
Peplis Portula, L.....	1	2				6					11	12		
Bryonia dioica, L.....	1	2	3	4		6	7	8	9	10		12		
Montia fontana, L.	1	2	3	4			7	8	9			12		14
Scleranthus annuus, L.....	1	2	3	4			7	8	9			12		
Ribes rubrum, L.		2		4			7		9					
—— nigrum, L.	1	2		4					9					
—— *alpinum, L.*.....		*												
—— Grossularia, L.....		†	†	†			†		†	†		†		
Sedum Telephium, L.		2								?		12		
——— acre, L.....		†	3	4		6	?	*	†	*		12	†	
——— *dasyphyllum, L.*						*		*		*				
——— *album, L.*.....								*						
——— reflexum, L.						*	*		*	10		†		†
——— Forsterianum, Sm. ...										10				
Cotyledon umbilicus, L.	1	2	3	4	5		7	8	9	10	11	12	13	14
Sempervivum tectorum, L. ...		*							*				*	*
Saxifraga granulata, L.....		2	3	4		6	7		9	10			13	
——— tridactylites, L.		2	3	4			7	8	9	10				
——— hypnoides, L. ...[L.		*				*					*	*		14
Chrysosplenium oppositifolium	1	2	3	4	5		7	8	9	10		12	13	14
——————— alternifolium,L.	1		3	4			7	8	9	10				14
Adoxa moschatellina, L.	1	2					7	8	9	10		12	13	14
Hedera Helix, L.	1	2	3		5	6	7	8	9	10		12	13	14
Cornus sanguinea, L.....		2	3			6	7	8	9	10	11	12	13	14
Hydrocotyle vulgaris, L		2		4				8	9			12	13	14
Sanicula europœa, L.....	1	2	3	4	5	6	7	8	9	10		12	13	14
Conium Maculatum, L.....		2	3	4			7	8	9	10		12	13	14
Petroselinum sativum, Hoffm.		*												
——————— segetum						6								
Helosciadium nodiflorum, Kh.		2	3	4			7	8	9	10	11	12	13	14
——————— inundatum, Kh.	1	2												
Sison Amomum, L.	1	2	3	4			7	8	9			12	13	
Ægopodium Podagraria, L. ...	1	2	3				7		9	10	11	12	13	14
Carum			3											
Bunium flexuosum, With. ...	1	2	3	4			7	8	9			12	13	14
Pimpinella Saxifraga, L.	1	2	3	4	5		7	8	9	10	11	12	13	14

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pimpinella magna, L.				4										
Sium angustifolium, L.		2	3						9					
Œnanthe fistulosa, L.		2					7	8	9			12	13	
——— Lachenalii, Gmel.		2						8						
——— silaifolia, Bab. ?		2												
——— crocata, L.		2	3				7	8	9	10	11	12	13	14
——— Phellandrium, Lam.		2	3					8		?			13	
Œthusa Cynapium, L.	1	2	3	4				8	9			12	13	14
Silaus pratensis, Bess.	1	2	3	4	5	6	7	8	9	10		12		
Angelica sylvestris, L.	1	2	3	4	5		7	8	9	10		12	13	14
Pastinaca sativa, L.				4								12		
Heracleum Sphondylium, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Daucus Carota, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Torilis Anthriscus, Gaertn.		2	3	4	5			8	9	10	11	12	13	14
——— infesta, Spr.	1	2	3					8	9					
——— nodosa, Gaertn.	1	2		4				8						
Scandix Pecten, L.	1	2	3	4		6	7	8	9			12	13	14
Anthriscus sylvestris, Hoffm.	1	2		4			7	8		10		12	13	14
——— *Cerefolium, Hoffm.*		+												
Chœrophyllum temulentum, L.	1	2		4	5		7	8	9	10	11			14
Myrrhis odorata, Scop.											11			14
Viscum album, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sambucus nigra, L.	1	2		4			7	8	9	10	11	12	13	14
——— ebulus, L.	1	2	3			6			9	10		12	13	
Viburnum opulus, L.		2	3	4		6		8	9	10		12	13	14
——— Lantana, L.		2	3	4						10		12		
Lonicera Periclymenum, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— *Xylosteum, L.*					*									
Rubia peregrina, L.		2												
Galium verum, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— cruciatum, With.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— palustre, L.	1	2	3			6	7	8	9	10		12	13	14
——— uliginosum, L.		2				6	7			10		12	13	14
——— saxatile, L.	1	2	3	4			7	8		10	11	12	13	14
——— Mollugo, L.	1	2	3	4	5	6	7	8		10		12	13	14
——— Aparine, L.	1	2	3			6	7	8	9	10		12	13	14
——— *boreale, L.*								*						
Sherardia arvensis, L.	1	2	3	4		6	7	8	9			12	13	
Asperula odorata, L.	1	2	3	4		6	7	8	9	10	11	12		
Centranthus ruber, D.C.							*		*					

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Valeriana dioica, L.	1	2	3	4		6	7	8	9	10		12		
——— sambucifolia, Mik.	1	2	3	4		6		8	9	10	11	12	13	14
Fedia olitoria, Vahl.		2	3	4					9				13	
—— *carinata, Stev.*												*		
—— Auricula, D. C.	1		3											
—— dentata, Bieb.	1	2	3	4					9	10				
Dipsacus sylvestris, L.	1	2	3	4		6	7	8	9	10		12		
——— pilosus, L.		2	3			6				10		12	13	14
Scabiosa succisa, L.	1	2	3	4		6	7	8	9	10	11	12	13	14
——— columbaria, L.							?			?				
Knautia arvensis, Coult.	1	2	3	4	5			8	9	10	11	12	13	14
Tragopogon minor, Fries.		2	3	4	5	6	7	8	9	10		12	13	
——— *porrifolius, L.*					5									
Helminthia echioides, Gaertn.		2	3	4		6		8						
Picris hieracioides, L.	1	2	3	4	5		7	8	9	10	11	12		14
Thrincia hirta, Roth.	1	2	3	4	5			8	9	10				
Apargia hispida, Willd.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— autumnalis, Willd.	1	2		4	5	6	7	8	9	10		12	13	14
Hypochæris radicata, L.	1	2		4		6	7	8	9	10	11	12		
Lactuca virosa, L.		2					7							
——— muralis, Less.	1	2	3	4	5		7	8	9	10	11	12	13	14
Sonchus arvensis, L.	1	2	3	4		6	7	8	9	10		12	13	14
——— asper, Hoffm.	1	2	3	4	5		7	8	9	10	11	12		14
——— oleraceus, L.	1	2	3	4		6		8	9	10		12	13	14
Crepis virens, L.		2	3	4	5		7	8	9	10	11	12		
Hieracium Pilosella, L.	1	2	3	4		6	7	8	9	10	11	12	13	14
—— ——— pallidum, Fries.		2												
——— lasiophyllum, Koch.		2												
——— murorum, L.	1	2					7			10		12		?
——— vulgatum, Fries.	1	2	3	?	5			8	9	10	11	12		14
——— gothicum, Fries. ?												12		
——— umbellatum, L.												12		14
——— boreale, Fries.	1	2	3	4	5			8	9	10	11	12		
Taraxacum officinale, Wigg.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— d. palustre, D.C.		2		4										
Lapsana communis, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cichorium Intybus, L.	†	†		4		6	7		9					
Arctium majus, L.	1	2	3	4			7	8	9	10			?	14
——— tomentosum, Pers.	1													
——— minus, Schkuhr.	1	2	3	4	5	6		8	9	10		12		
Serratula tinctoria, L.		2		4					9					

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Carduus nutans, L.	1	2	3	4		6	7	8	9	10		12		
——— acanthoides, L.	1	2	3	4		6		8	9	10	11			
——— *marianus, L.*		*				†	†							
——— lanceolatus, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— eriophorus, L.		2	3	4		6			9	10			13	14
——— palustris, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— arvensis, Coult.	1	2	3	4	5	6	7	8	9	10		12	13	14
——— pratensis, Huds.	1													
——— acaulis, L.		2	3			6								
Onopordum Acanthium, L.		*							*					
Carlina vulgaris, L.	1	2	3	4				8	9	10	11	12	13	14
Centaurea nigrescens, Angl.	1	2	3						9	10				
——— nigra, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— Cyanus, L.		†		4				8					13	
——— Scabiosa, L.		2		4		6		8	9				13	14
Bidens cernua, L.	1	2	3						9			12		
——— tripartita, L.		2	3				7	8	9	10		12		
Eupatorium cannabinum, L.	1	2	3	4	5	6	7	8	9	10		12		
Tanacetum vulgare, L.	1	2	3	4			7	8	9	10		12		
Artemisia Absinthium, L.		2	3	4				8	9	10		12		
——— vulgaris, L.	1	2	3	4	5	6	7	8	9	10		12		14
Gnaphalium sylvaticum	1	2		4						10		12		
——— uliginosum	1	2	3	4		6	7	8	9	10	11	12		14
Filago minima, Fries.	1	2		4					9		11	12		
——— germanica, L.	1	2	3	4		6	7	8	9	10		12		14
Petasites vulgaris, Desf.	1	2					7	8	9	10		12	13	14
Tussilago, Farfara, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
Erigeron acris, L.	1	2			5				9					
Solidago Virgaurea, L.	1	2		4				8	9	10		12		14
Senecio vulgaris, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— sylvaticus, L.	1	2	3	4			7	8					?	
——— erucæfolius, L.	1	2		4					9					
——— Jacobæa, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— aquaticus, Huds.	1	2	3					8	9	10	11	12	13	14
Doronicum Pardalianches, L.												*		
Inula Helenium, L.	1							†	9	10			13	
——— Conyza, D. C.	1	2	3	4	5		7	8	9	10		12		
Pulicaria dysenterica, Gaertn.	1	2	3	4		6	7	8	9	10		12	13	14
——— vulgaris, Gaertn.														14
Bellis perennis, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chrysanthemum segetum, L.		*	3	4			7	8	9	10	11	12	13	
——— Leucanthemum, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
Pyrethrum Parthenium, Sm...		†		4		6	7	8	9	10		12		14
——— inodorum, Sm. ...	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Matricaria Chamomilla, L. ...		2	3	4			7	8	9	10	11	12		14
Anthemis arvensis, L.	1	2		4						10				
——— Cotula, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Achillæa Ptarmica, L.	1	2	3	4	5	6	7	8	9	10		12		14
——— Millefolium, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Campanula rotundifolia, L. ...	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— patula, L.	1	2	3	4	5	?	7	8	9	10	11	12	13	14
——— Rapunculus, L. ...		2								?				
——— latifolia, L.	1	2	3				7	8				12	13	
——— Trachelium, L. ...		2	3	4	5	6		8	9	10		12		
Wahlenbergia hederacea, Rich.								8						
Specularia hybrida, A. D. C.		2	3				7		9					
Jasione montana, L.		2		4		6			9	10		12	13	
Erica tetralix, L.											11			14
—— cinerea, L.		2	3										13	
Calluna vulgaris, Salisb.	1	2	3	4			7	8	9	10	11	12	13	14
Vaccinium Myrtillus, L.		2	3	4						10	11	12		14
——— Vitis Idæa, L.														14
Pyrola minor, L.		2							9					
Monotropa Hypopitys, L.		2												
Ilex Aquifolium, L.	1	2	3	4	5		7	8	9	10		12	13	14
Ligustrum vulgare, L.		2	3	4		6		8	9			12		
Fraxinus excelsior, L.	1	2	3	4			7	8	9	10		12	13	14
†Vinca minor, L.	1	†	3	4			†					12		14
—— *major*, L.		†	†									†		
Gentiana Amarella, L.	1	2	3	4					9	10			13	
Erythræa Centaurium, Pers....	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chlora perfoliata, L.	1	2	3	4		6	7	8	9				13	14
Menyanthes trifoliata, L.		2		4		6		8	9	10		12	13	
*Polemonium cœruleum, L. ...													13	
Convolvulus arvensis, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— sepium, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
Cuscuta epilinum, Weihe. ...		†												
——— *Trifolii, Bab.*	†	†							†					
Hyoscyamus niger, L.	1	2	3				7	8		10			13	
Solanum nigrum, L.		2					7	8						
——— Dulcamara, L.	1	2	3	4	5	6	7	8	9	10		12		

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Atropa Belladonna, L.		2					7	8		?				
Verbascum Thapsus, L.	1	2	3	4		6	7	8	9	10	11	12		
——— Blattaria, L.			3					8		?				
——— virgatum, With.	1	2					7		9					
——— nigrum, L.							7							
Veronica arvensis, L.		2	3	4				8	9	10	11	12		14
——— serpyllifolia, L.	1	2	3	4		6	7	8	9	10	11	12		14
——— scutellata, L.		2		4				8	9		11	12	13	
——— b. parmularia, Tratt.									9					
——— Anagallis, L.	1	2	3			6	7	8	9			12	13	
——— Beccabunga, L.		2	3	4	5	6		8	9	10	11	12		14
——— officinalis, L.	1	2		4		6	7	8	9	10				14
——— montana, L.		2	3	4			7	8	9	10				14
——— Chamædrys, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— hederifolia, L.	1	2	3	4			7	8	9	10		12		14
——— agrestis, L.	1	2	3	4			7	8	9	10		12		14
——— polita, Fries.		2	3	4			7	8	9			12		
——— *Buxbaumii, Ten.*	?	2	3				7			10		12		14
Bartsia Odontites, Huds.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Euphrasia officinalis, L.	1	2	3			6	7	8	9	10		12	13	14
Rhinanthus Crista galli, L.	1	2	3			6	7	8	9	10		12	13	14
Melampyrum pratense, L.	1	2	3		5	6	7	8	9	10	11	12		14
Pedicularis palustris, L.	?	2	3							10		12		
——— sylvatica, L.	1	2	3			6	7	8	9	10		12		14
Scrophularia nodosa, L.	1	2	3			6	7	8	9	10	11	12		14
——— Ehrharti, Stev.			3						9	10		12		
——— aquatica, L.	1	2	3	4	5	6	7	8	9	10		12	13	14
Digitalis purpurea, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Antirrhinum majus, L.							†					†		
——— Orontium, L.	1	2											13	
Linaria Cymbalaria, Mill.						†	†	†		†		†		
——— spuria, Mill.									9					
——— Elatine, Mill.	1	2	3	4		6		8	9				13	14
——— vulgaris, Mill.	1	2	3			6	7	8	9	10	11	12		
——— minor, Desf.	1	2	3			6		8	9	10		12		
Limosella aquatica, L.												12	13	
Orobanche major, Augl.		2	3	4	5	?	7	?					13	
——— minor, Sutt.	1	2					7	8					13	
Lathræa squamaria, L.			3		5		7	8	9				13	14
Verbena officinalis, L.	1	2					7	8	9		11	12	13	14
†Salvia verbenaca, L.		†					†							

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Lycopus europæus, L.		2	3			6	7	8	9	10		12		
Mentha rotundifolia, L.....	1	2			5				9	10		12		
——— sylvestris, L.....	1	2	3			6	7	8				·		14
†——— ——— b. viridis...														†
——— piperita, L.		2	3	4										
——— aquatica, L.	1	2	3			6	7	8	9	10		12		14
——— ——— b. citrata, Ehrh.	1													
——— sativa, L.	1	2					7	8	9					14
——— ——— b. rubra, Sm....		2						8	9	10		12		
——— ——— c. gentilis, Sm.		2					7			10				
——— arvensis, L.	1	2	3			6	7	8	9	10	11	12		14
Thymus Serpyllum, L.	1	2		4		?		8	9	10		12		?
——— Chamædrys, Fries. ...	1	2			5					10	11			
Origanum vulgare, L.	?	2	3				7	8	9	10		12		14
Calamintha officinalis, Angl....	1	2	3					8	9			12		14
——— Clinopodium Spen.		2	3		5	6	7	8	9	10	11	12		14
Melissa officinalis, L.		†												
Teucrium, Scorodonia, L.	1	2	3			6	7	8		10	11	12		14
Ajuga reptans, L.	1	2	3	4		6	7	8	9	10		12	13	14
Ballota nigra, L.	1	2	3			6	7	8	9	10		12		
Leonurus Cardiaca, L......	†	?		?										
Lamium Galeobdolon, Crantz.	1	2	3	4		6	7	8	9	10		12		
——— album, L.	1	2	3	4		6	7	8	9	10	11	12	13	14
†——— maculatum, L.....													†	†
——— amplexicaule, L.		2					7					12		14
——— purpureum, L...	1	2	3			6	7	8	9	10	11	12	13	14
——— incisum, Willd.		2				?								
Galeopsis Ladanum, L.	1	2	3				7	8	9		11		13	
——— Tetrahit, L.	1	2	3		5	6	7	8	9	10		12		
——— versicolor, Curt. ...	?									10		12		
Stachys Betonica, Benth.	1	2	3		5		7	8	9	10	11	12	13	14
——— palustris, L.	1	2	3			6	7	8	9	10	11	12		14
——— sylvatica, L.....	1	2	3		5	6	7	8	9	10		12		
——— arvensis, L.	1	2	3				7	8	9	10		12		
Glechoma hederacea, L.	1	2	3			6	7	8	9	10	11	12	13	
Nepeta Cataria, L.....	1	2	3			?	7		9					
Marrubium vulgare, L.....	1	2					7							
Prunella vulgaris, L.....	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Scutellaria galericulata, L.....		2					7	8	9			12	13	
Myosotis palustris, With.	1	2	3	4		6	7	8	9	10		12	13	
——— cæspitosa, Schultz. ...		2	3		5	6		8	9		11	12		

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Myosotis arvensis, Hoffm.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— collina, Hoffm.	1	2	3	4			7		9					
——— versicolor, Lehm.		2	3	4		6	7	8	9	10		12	13	14
Lithospermum officinale, L.		2	3	4			7	8	9	10			13	
——— arvense, L.	1	2	3	4		6	7	8	9			12		
——— purpuro-cæruleum ?														
Symphytum officinale, L.	1	2	3				7	8	9	10		12	13	14
Lycopsis arvensis, L.	1	2		4										
Cynoglossum officinale, L.		2	3	4		6	7	8	9	10		12	13	
*Pulmonaria officinalis, L.					†	?								
Echium vulgare, L.		+	+									12		
Pinguicula vulgaris, L.		2						8	9	10		12	13	14
Utricularia ?													13	
Primula vulgaris, L.	1	2	3	4		6	7	8	9	10		12	13	14
——— ——— b. elatior, Aut.			3	4				8	9	10		12		
——— veris, L.	1	2	3	4		6	7	8	9	10		12		14
Lysimachia vulgaris, L.		2	3				7	8	9					
——— Nummularia, L.	1	2	3	4		6	7	8	9	10		12		
——— nemorum, L.	1	2	3	4	5		7	8	9	10		12		14
Anagallis arvensis, L.	1	2	3	4		6	7	8	9			12		14
——— cærulea, Ant.	1													
——— tenella, L.		2	3					8	9	10		12	13	14
Centunculus minimus, L.				4										
Plantago major, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— media, L.	1	2	3	4	5	6	7	8	9	10		12		14
——— lanceolata, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
——— Coronopus, L.		2		4										
Chenopodium polyspermum, L.		2	3	4		6						12		
——— intermedium, M.		2		4		6	?		9			12		
——— rubrum, L. [& K.		2	3	4		6	7							
——— murale, L.							7							
——— album, L.	1	2	3	4			7		9	10	11	12		
——— b. viride, L.		2		4										
——— Bonus Henricus, L.	1	2	3	4			7	8	9	10		12	13	14
Atriplex patula, E. B.		2	3	4			7		9					
——— deltoidea, Bab.		2		4										
——— angustifolia, Sm.	1	2	3	4	5		7		?	10		12		
——— erecta, Huds.	1	2	3	4		6	7		9	10	11			
Blitum virgatum, L.		†												
Polygonum Bistorta, L.		2					7	8	9	10		12	13	
——— amphibium, L.	1	2	3	4		6	7	8	9	10				14

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Polygonum lapathifolium, L...	1	2		4			7	8	9	10				
——— laxum, E. B. S. ...		2	3							10		12		
——— Persicaria, L.	1	2	3	4		6	7	8	9	10		12		14
——— Hydropiper, L. ...	1	2	3	4		6	7	8	9	10		12		14
——— aviculare, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
——— convolvulus, L ...		2	3	4			7	8	9	10	11	12		
Rumex Hydrolapathum, H. ...		2	3											14
——— crispus, L.....	1	2	3	4	5	6	7	8	9		11	12		
——— pratensis, M. & K. ...		2	?											
——— obtusifolius, L.....	1	2	3	4	5		7	8	9		11	12	13	14
——— sanguineus, L. b. viridis	1	2	3	4	5	6	7	8	9	10	11	12		
——— conglomeratus, Murr.		2		4				8	9		11	12		
——— acetosa, L.....	1	2		4		6	7	8	9	10	11	12	13	14
——— acetosella, L.....	1	2	3	4		6	7	8	9	10	11	12	13	14
Daphne Laureola, L.....	1	2	3	4	5	6	7	8	9			12	13	14
——— Mezereum, L.		?			5		*							
Empetrum nigrum, L.														14
Euphorbia helioscopia, L.	1	2	3	4		6	7		9	10	11	12	13	14
——— exigua, L.....	1	2	3	4	5	6	7	8	9			12		14
——— Peplus, L.	1	2	3	4			7	8	9	10		12		
——— Lathyris, ?							?							
——— amygdaloides, L. ...	1	2		4	5	6	7	8	9	10		12		14
Buxus sempervirens, L......							†			†		†		
Mercurialis perennis, L.	1	2	3		5	6	7	8	9	10	11	12	13	14
——— b. ovata, Steud. ...		2												
——— *annua, L.*		†												
Urtica urens, L.....	1	2	3	4		6	7	8	9	10		12		
——— dioica, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Parietaria diffusa, Koch.		2				6	7	8	9	10		12	13	14
Humulus Lupulus, L.	1	2	3	4		6	7	8	9	10		12		14
Ulmus montana, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	
—— *suberosa, Ehrh.*.....								†		†				
—— campestris, Sm.	1	2		4			7	8	9	10	11	12		
—— *glabra, Mill.*		†								†				
Quercus pedunculata.....	1	2	3	4			7	8	9	10	11	12		?
——— sessiliflora, Sm.....	1	2		4			7	8	9	10		12		
——— var. intermedia, Leight		2		4				8		?		12		
Fagus sylvatica, L.	†	2	3	†			†	†	9	10		12		14
Carpinus Betulus, L.									†	†				†
Corylus Avellana, L.....	1	2	3	4		6	7	8	9	10	11	12	13	14
Alnus glutinosa, L.	1	2	3	4	5		7	8	9	10		12	13	14

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Betula alba, L.		2	3						9	10		12		14
—— glutinosa, Wallr.	1	2						8		10				
Populus alba, L.									?	?				?
† —— canescens, Sm.	*	*		4	5				9	10				
—— tremula, L.	1	2						8	9	10	11	12		
—— *nigra, L.*		*					*		*			*		
Salix pentandra, L.									*					
—— fragilis, L.		2								10		12		
—— Russelliana, Sm.		2							9	10				
—— alba, L.		2					7	8						
—— cærulea, Sm.		2												
—— *vitellina, Sm.*		+												
—— undulata, Ehrh.		2												
—— triandra, Sm.		2						8	9	10				
—— triandra, Curt.		2												
—— Hoffmanniana, Sm.		2						8						
—— amygdalina, Sm.		2												
—— *Helix, L.*		+												
—— viminalis, L		2						8						
—— *Smithiana, Eng., Bot.*	†	†					?		?	?				
—— ferruginea, And.		2												
—— Cinerea, Sm.	1	2					7	8	9	10				
—— —— b. aquatica, Sm.		2						8						
—— —— c. oleifolia, Sm.		2												
—— aurita, L.	1	2	3						9	10				
—— capræa, L.	1	2				6	7	8		10		12		
—— nigricans, Fries.										10				
Juniperus communis, L.			3	4				8		10		12		
Taxus baccata, L.		2	3	4	5			8	9	10				14
Spiranthes autumnalis, Rich.	1	2	3					8	9		11	12	13	14
Neottia Nidus-avis, Rich.		2	3	4	5		7	8		10			13	
Listera ovata, Br.	1	2	3	4		6		8	9	10				14
Epipactis latifolia, Sm.	1	2	3	4		6	7	8	9	10		12		14
—— ovalis, Bab.		2											•	
—— palustris, Sm.				4	5			8		10		12		
Cephalanthera grandiflora, Bab.		2												
—— ensifolia, Rich.		2	3											
Epipogium aphyllum, Sm.					5									
Orchis Morio, L.	1	2	3	4		6	7	8	9	10		12	13	14
—— mascula, L.	1	2	3	4			7	8	9	10		12	13	14
—— ustulata, L.		2	3							?				

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Orchis pyramidalis, L.			3		5				9				13	
—— latifolia, L.	1	2				6	7	8	9				13	
—— maculata, L.	1	2	3	4		6	7	8	9	10		12	13	14
Gymnadenia conopsea, Br.	1				5		7	8	9			12	13	
Habenaria bifolia, Br.	1		3	4		?		8	9	10		12	13	
—— chlorantha, Bab.		2	3	4				8	9				13	14
—— viridis, Br.	1		3			6	7	8	9			12		
Ophrys apifera, Huds.		2	3		5			8	9				13	
—— muscifera, Huds.		2												
Iris fœtidissima, L.		2	3				7	8						
— Pseud-acorus, L.	1	2	3			6	7	8	9	10		12	13	14
Narcissus biflorus, Curt.	†	†		†			†	†			†	†		
—— Pseudo-narcissus, L.	1	2	3	4		6	7	8	9			12	13	
Galanthus nivalis, L.		†		4	5		7	†	9	10				
†Allium schœnoprasum, L.													13	
—— vineale, L.		2							9			12		
—— ursinum, L.	1	2	3	4		6		8		10		12		
Gagea lutea, Ker.		2												
Ornithogalum nutans, L.		*												
Hyacinthus nonscriptus, L.	1	2	3	4		6	7	8	9	10	11	12	13	14
Ruscus aculeatus						6								
Convallaria majalis, L.		2	3		5			8						
—— multiflora, L.					5				9					
Paris quadrifolia, L.	1	2	3	4		6	7	8	9	10			13	14
Tamus communis, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Colchicum autumnale, L.	1	2	3	4			7	8	9	10		12	13	14
Anacharis alsinastrum, Bab.	*	*					*							
Alisma Plantago, L.		2	3		5	6	7	8	9	10		12	13	
—— ranunculoides, L.		2	3									12		14
Sagittaria sagittifolia, L.		2				6	7							
Butomus umbellatus, L.		2	3				7	8	9					
Triglochin palustre, L.		2		4				8	9			12	13	
Potamogeton densus, L.		2					7		9	10		12		
—— pectinatus, L.		2	3							10				
—— pusillus, L.	1				5				9				13	
—— gramineus, L.	1													
—— crispus, L.	1	2	3				7	8	9	10		12		
—— perfoliatus, L.		2	3				7	8	9				13	
—— lucens, L.		2	3					8						
—— natans, L.	1	2	3		5	6		8	9	10		12		
—— oblongus, Vir.		2												

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	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	PROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Zannichellia palustris, L.		2	3						9					
Lemna minor, L.	1	2	3				7	8	9	10		12		14
—— gibba, L.	1	2	3				7			10		12		
—— polyrrhiza, L.		2					7							
—— trisulca, L.	1	2						8	9			12		
Arum maculatum, L.	1	2	3	4		6	7	8	9	10		12	13	
Sparganium minimum, Fries.	1													
—— simplex, Huds.		2	3		5			8	9					
—— ramosum, Huds.	1	2	3		5	6		8	9	10		12		
Typha latifolia, L.	1	2	3		5		7	8	9	10				
—— angustifolia, L.									9					
Juncus conglomeratus, L.	1	2	3	4			7	8	9	10		12		
—— effusus, L.	1	2	3	4				8	9	10	11	12		
—— glaucus, Sibth.	1	2	3	4	5			8	9	10		12		
—— diffusus, Hoppe.		2												
—— acutiflorus, Ehrh.	1	2	3	4				8	9	10				
—— lamprocarpus, Ehrh.	1	2	3	4					9	10		12		
—— obtusiflorus, Ehrh.		2						8				12		
—— supinus, Mœnch.		2	3	4						10		12		
—— compressus, Jacq.		2	3	4			7							
—— bufonius, L.	1	2	3	4	5		7	8	9	10	11	12		14
Luzula sylvatica, Bich.	1	2	3	4				8	9	10	11			
—— pilosa, Willd.	1	2	3	4			7	8		10		12		
—— Borreri, Bronf.		2	3											
—— Fosteri, D. C.	1	2	3				7	8		10				
—— campestris, Br.	1	2	3	4			7	8	9	10		12		
—— multiflora, Lej.		2		4			7	8	9	10				
Blysmus compressus, Panz.		2		4				8	9			12		
Scirpus lacustris, L.	1		3	4					9					
—— setaceus, L.		2	3					8		10	11	12	13	
—— sylvaticus, L.		2	3					8				12		
—— palustris, L.		2	3		5		7	8	9			12		
—— pauciflorus, Lightf.		2										12		
—— acicularis, L.		2								10				
—— fluitans, L.												12		
Eriophorum angustifolium, Rh.		2		4		6			9	10		12		14
—— latifolium, Hoppe.		2		4								12		
Carex pulicaris, L.		2						8	9	10		12		
—— stellulata, Good.	1	2						8	9	10		12	13	
—— ovalis, Good.	?	2						8	9	10		12	13	
—— remota, L.		2	3					8	9			12		

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	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Carex axillaris, Good.												12		
—— intermedia, Good.		2					7	8	9					
—— muricata, L.	1	2	3	4				8		10				
—— divulsa, Good.....	1	2	3				7	8	9					
—— vulpina, L.	1	2	3		5		7	8	9			12		
—— paniculata, L.	1	2										12		
—— vulgaris, Fries.		2						8	9	10		12		
—— acuta, L.		2					7	8						
—— flava, L.		2	3					8	9	10		12	13	
—— Œderi, Adt.														
—— pallescens, L.		2	3					8	9			12		
—— fulva, Good.		2						8	?	10		12		
—— binervis, Sm.		2	3											
—— panicea, L.	1						7	8	9			12		
—— strigosa, Huds.		2		4										
—— sylvatica, Huds.	1	2	3				7	8	9	10		12		
—— pendula, Huds.		2		4			7					12		
—— Pseudo-cyperus, L.....	1						7		9					
—— glauca, Scop.	1	2	3				7	8	9	10		12		
—— præcox, Jacq.	1	2	3					8	9	10	11	12		
—— montana, L.....		2												
—— pilulifera, L.	1	2												
—— clandestina, Good.		2												
—— digitata, L.....		2												
—— hirta, L.	1	2	3					8	9			12		
—— ampullacea, Good.		2										12	13	
—— vesicaria, L.....		2						8	9			?	13	
—— paludosa, Good.		2					7	8	9	10		12		
—— riparia, Curt.		2	3				7	8	9					
Phalaris arundinacea, L.		2		4			7		9			12		14
Anthoxanthum odoratum, L.	1	2	3	4			7	8	9		11	12		14
Phleum pratense, L.	1	2		4	5			8	9	10	11	12		14
Alopecurus pratensis, L.	1	2	3	4		6	7	8	9	10	11	12		14
——— geniculatus, L. ...		2	3	4			7	8	9			12		
——— agrestis, L.			3	4	5	6	7	8	9	10		12		
Gastridium lendigerum, Gadd.							7							
Milium effusum, L.	1	2	3	4			7		9					
Agrostis canina, L.....		2		4					9	10		12		
——— vulgaris, With.		2	3	4				8	9	10	11	12		14
——— alba, L.	1	2	3		5			8	9	10	11	12		
Arundo Phragmites, L.....		2							9			12		14

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	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Arundo Epigejos, L.		2												
Aira cæspitosa, L.	1	2	3	4	5		7	8	9	10	11	12		14
—— flexuosa, L.	1	2		4			7		9	10	11	12		14
—— caryophyllea, L.		2	3	4				8		10	11	12		
—— præcox, L.	1	2	3	4			7				11	12		
Avena fatua, L.	1	2	3	4				8				12		
—— strigosa, Schreb.		*												
—— pubescens, L.		2	3	4	5		7							14
—— flavescens, L.	1	2	3	4			7	8	9	10	11	12	13	14
Arrhenatherum avenaceum,	1	2	3	4	5		7	8	9	10	11	12		14
Holcus lanatus, L. [Beauv.		2	3	4	5		7	8	9	10	11	12	13	14
—— mollis, L.	1	2	3	4	5		7	8	9		11	12	13	14
Triodia decumbens, L.	1	2						8	9	10		12		
Kœleria cristata, Pers.										10				
Melica uniflora, Retz.	1	2	3	4	5		7	8	9	10	11	12		
—— nutans, L.		2												
Molinia cærulea, Mœnch.		2		?				8	9			12		
Catabrosa aquatica, Presl.		2	3	4			7		9	10		12		
Glyceria aquatica, Sm.		2	3				7							
—— fluitans, Br.	1	2	?	?			7	8				12		14
—— plicata, Fries.	1	2	3		5		7	8	9	10		12		
—— pedicellata, Towns.		2			5									
—— distans, Wahl.		2												
—— rigida, Sm.		2	3	4			7			10				
Poa annua, L.	1	2	3	4			7	8	9	10	11	12		14
—— pratensis, L.	1	2		4	5		7	8	9			12		14
—— trivialis, L.	1	2	3	4			7	8	9		11	12		
—— compressa, L.	1	2	3	4			7		9	10				
—— nemoralis, L.	1	2					7		9	10		12		
Briza media, L.	1	2	3		5	6	7	8	9	10		12		14
Cynosurus cristatus, L.	1	2		4	5		7	8	9	10		12	13	14
Dactylis glomerata, L.	1	2	3	4	5		7	8		10	11	12	13	14
Festuca bromoides, L.	1	2		4				8	9	10	11	12		
—— pseudo-myurus, Soy.			3	4			7	8	9			12		
—— ovina, L. [Will.		2	3	4				8	9	10	11		13	14
—— duriuscula, L.	1	2		4			7	8	9	10				
—— arundinacea, Schreb.		2								?		12		
—— pratensis, Huds.	1	2	3	4				8	9	10	11	12		14
—— loliacea, Huds.	1	2		4						10		12		

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	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bromus giganteus, L.	1	2	3	4	5		7	8	9	10	11			14
—— asper, L.	1	2		4	5		7	8	9	10	11	12	13	14
—— sterilis, L.	1	2	3	4			7	8	9	10		12	13	14
—— erectus, Huds.		2	3	4										
* —— secalinus, L.		2							9					
—— commutatus, Schreb.	1	2		4		6								
—— mollis, L.	1	2	3	4			7	8	9	10	11	12	13	14
—— var. pseudo-racemosus		2		4				8	9	10				
Brachypodium sylvaticum, Beauv.		2	3	4	5			8	9	10	11	12		
—— pinnatum, Beauv.		2		4										
Triticum caninum, Huds.		2		4				8	9			12		
—— repens, L.	1	2	3	4	5			8	9	10		12	13	14
Lolium perenne, L.	1	2	3	4	5		7	8	9	10	11	12	13	14
—— *italicum, Braun.*		*		*						*				
Hordeum sylvaticum, Huds.		2												
—— pratense, Huds.		2	3	4			7	8	9					
—— murinum, L.	1	2	3	4			7							
Nardus stricta, L.		2							9	10		12		
Ceterach officinarum, Willd.	1	2					7		9	10		12	13	14
Polypodium vulgare, L.	1	2	3	4	5	6	7	8	9	10	11	12		14
—— Phegopteris, L.	1									10				14
—— Dryopteris, L.		2								10				14
—— calcareum, Sm.		2												14
Cystopteris fragilis, Bernh.		2						8		10			13	14
Polystichum aculeatum, Roth.	1	2		4	5		7		9	10		12		14
—— var. lobatum, Sw.	1			4			7	8	9	10		12		14
—— augulare, Newm.	1	2	3	4			7	8	9	10		12		14
Lastrea Filix-mas, Presl.	1	2	3	4	5		7	8	9	10	11	12		14
—— var. padeacea, Mbore.		2												
—— Oreopteris, Presl.	1	2					7	8		10		12		14
—— spinulosa, Presl.	1	2	3	4			7		9	10		12		14
—— dilatata, Presl.		2		4			7	8	9					14
—— fœnisecii, Wats.		2												
Athyrium Felix-fœmina, Roth.		2		4	5		7	8	9	10		12		14
—— rhœticum, Roth.	1	2					7			10	11			
Asplenium Trichomanes, L.	1	2	3	4			7	8	9	10	11	12	13	14
—— viride .....?...														
—— Adiantum nigrum	1	2		4			7	8	9	10		12	13	14

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	NUMBER AND NAME OF DISTRICT.													
	ST. WEONARDS.	ROSS.	WOOLHOPE.	LEDBURY.	BROMYARD.	FROME.	HEREFORD.	WEOBLEY.	LEOMINSTER.	AYMESTRY.	KINGTON.	PEMBRIDGE.	GOLDEN VALLEY.	BLACK MOUNTAIN.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Asplenium Ruta-muraria, L.	1	2	3	4			7	8	9	10	11	12	13	14
Scolopendrium vulgare, Sym.	1	2	3	4	5	6	7	8	9	10		12		14
Blechnum boreale, Sm.	1	2	3	4	5		7	8	9	10		12		14
Pteris aquilina, L.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Botrychium Lunaria, Sw.				4	5	6	7		9	10	11	12	13	
Ophioglossum, vulgatum, L.	1	2	3			6		8	9	10			13	
Lycopodium clavatum, L.										10	11			14
—— —— Selago														14
Equisetum Telmateja, Ehrh.		2			5		7	8		10				
—— —— arvense, L.	1	2				6	7	8	9	10		12		14
—— —— sylvaticum, L.	1						7			10				
—— —— palustre, L.	1	2	3			6	7	8	9	10		12		14
—— —— limosum, L.		2	3		5		7		9					
—— —— hyemale, L.	1	2												

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FLORA

OF

HEREFORDSHIRE.

DEFINITION OF DISTRICTS,

WITH

NOTES ON THEIR GEOLOGY,

BY THE REV. W. S. SYMONDS, F.G.S., &c.

NO. 1. THE ST. WEONARD'S DISTRICT.

This District, which occupies the southern angle of the County, consists of the basin of the river Garran, together with the tract to the N. W. of this as far as the Worm Brook.

It forms an irregular parallellogram, one of whose longer sides extending from Gannerew to Monmouth Cap Inn, is bounded by the County of Monmouth; the opposite longer side, and the South Eastern shorter side, are defined by the line of watershed between the Garran basin and the valley of the River Wye—a line which is represented with sufficient exactness by the turnpike road from Hereford to Monmouth, passing in its course the following places: Dewsall, Wormelow Tump, Llanwarne, Harewood End, New Inn, Marstow, Whitchurch, and Gannerew. The remaining shorter side is determined by the Worm Brook.

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GEOLOGY.—The St. Weonards district is composed of beds of the *Cornstone* series of the Old Red Sandstone. The Cornstone deposits of the great series of rocks known as the Old Red Sandstone, or Devonian system of Geologists, commence low in the Old Red deposits as thin Cornstones, or impure concretions of lime and marl, interstratified with red, yellowish, and white coloured sandstones and beds of clay and marl.

The lowest bands may be seen at Ledbury tunnel, where they pass downwards into the Downton sandstone and upper Ludlow shales, and upwards into red marls, grey sandstones, and marly impure cornstones, which constitute the lower Old Red sandstone of Herefordshire and Monmouthshire.

Sub-crystalline masses of impure limestone, vulgarly called "cornstones," occur some hundreds of feet higher in the Old Red rocks of Herefordshire than the calcareous bands of the lower deposits above mentioned. They are quarried at Kilpeck, north of the St. Weonards district, and again at Kentchurch and below Orcop Hill, where, in company with my friend MR. LINGWOOD, I obtained fragments of the Old Red fish Pteraspis, and Cephalaspis. The hills of Kentchurch Park, Saddlebow, Rowlstone, and Orcop, are capped with grey sandstones and marls, which I look upon as the summit of the cornstone series, and which pass upwards on the Skyrrid, near Abergavenny, in the Black Mountains, the Blorenge, Sugar Loaf, Daren, and Pen-Cerrig-Calch into the brownstones, marls, and chocolate coloured sandstones, which, with the overlying conglomerate and yellow sandstone, constitute the upper Old Red. At Orcop, Saddlebow, and Kentchurch hills, the brownstone series are denuded, and I believe but *just* denuded. The southern division of the St. Weonards district, at Gannerew, passes into a district most interesting to the geologist, and revealing a most complicated geological history.

The geologist who would comprehend the wondrous physical geology of Herefordshire and Monmouthshire, will soon learn the necessity of visiting many distant hills and rolling vales before he can hope to understand the geology of a single district of the land of the Old Red. It must suffice here to remark that the rocks of the Old Red that underlie the Carboniferous limestone of the Great Doward and Symonds's Yat, a little south of Gannerew and Whit-

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church, are the equivalent beds of those Old Red deposits which cap the summit of the Sugar-loaf and the Skyrrid, range high up on the Daren, and support the outlying limestone of the lofty Pen-cerrig Calch. When, therefore, we examine the position of the Carboniferous limestone at the great Doward, and reflect that the hills of Garway, Orcop, Kentchurch, and many others in the St. Weonards district belong to the cornstone series of the Old Red, we shall be at once struck by the upheaval which has elevated the cornstone strata to the north of Gannerew, and depressed them towards the south.

NO. 2. THE ROSS DISTRICT.

This consists mainly of the valley of the Wye from the borders of Gloucestershire on the south, to Aconbury Hill and Mordiford on the north. The western boundary is formed by the line of road from Gannerew, northward, to Dewsall, described under District 1. From Dewsall, at the north-western base of Aconbury Hill, the northern boundary follows a small brook eastward to the river Wye, crossing which at Mordiford, it takes the course of the turnpike road to the S.S.E. through Fownhope, Old Gore, Crowhill, and Broomsash, reaching the borders of Gloucestershire near the Lea.

The S. and S.E. parts Copped Wood Hill, near Goodrich, although formerly an outlying portion of Monmouthshire, is physically a part of Herefordshire, and is therefore included in this district. By including the hills of Great and Little Doward in this district, all such portions as belong to Herefordshire, of the belt of Carboniferous limestone which surrounds the Dean Forest Coalfield, are included in one and the same district. Thus the plants of these limestone rocks appear in one district list only, instead of two, which might have given rise to an impression that they are distributed over a larger portion of the County than is really the fact. The tract of country included in this district has long been deemed the most fertile portion of Herefordshire. Botanically it is rich in species, and this, as well from the varied character of its surface, as from the addition of the limestone plants. Of the Herefordshire rocks, the carboniferous limestone is, I believe, by far the richest as to the number of plants it produces; not only are some of the most rare

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and local species confined to it, but in addition to these specialities, it produces a larger number of the remaining species, in the county list than does any other rock. It must, however, be owned that this last remark is made from memory, and has not yet been strictly tested by the formation and comparison of distinct catalogues of the plants of the different geological formations.

GEOLOGY.—The south and south-eastern portions of the Ross district as above described, include the hills of Great and Little Doward, as well as Howle Hill; all of which consist of strata of the Carboniferous epoch.

On the banks of the Wye, opposite Whitchurch and below Symonds's Yat, there is a section which shews the transition from the upper beds of the Old Red sandstone, the conglomerate or pudding-stone, and the yellow sandstone, to the overlying carboniferous limestone shale, and carboniferous or mountain limestone.

The upper part of the section is much obscured, but may be traced by the yellow sands which crop out on ascending from the Wye ferry to the rocks of Symonds's Yat.

I recommend my brother geologists to examine a far superior developement of the transition rocks between the Old Red and Carboniferous systems at Drybrook, on the Ross and Drybrook road, and of which I have given the particulars in a former work.*

I rejoice that Howle Hill falls within the district of the Herefordshire Flora, for a band of the lower coal measures still remains there, a relic, as it were, to remind the botanist of the most profuse vegetation the world has ever beheld.

Ascending to Howle Green, and Howle Hill, from Ross, the explorer passes successively over the upper beds of the Old Red sandstone, the mountain limestone shale and limestone, the millstone grit, and lower coal measures. The following may be taken as the arrangement of the strata in passing from the Speech-house in Dean Forest, to the rocks of Ross.

1. Upper sandstone and clays with various coal seams, lower sandstone and lower coal seams.
2. Millstone grit.

* Stones of the Valley.

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3. Carboniferous (mountain) limestone, with limestone shale underlying.

4. Yellow sands with red bands, and red marls.

5. Old Red conglomerate, and marls and sandstones.

6. Red sandstones of Ross district, as below the Royal Hotel.

I have often searched the Old Red quarries of the Ross district for fossils, but hitherto unsuccessfully. There are quarries at Pengethly and Hentland where the new parsonage house is built of excellent stone by the Rev. W. Poole, Harewood, and many other localities. The railroad also cut through a considerable amount of Old Red rock, but I never succeeded in obtaining, or even hearing of a fossil. The Carboniferous limestone of the Dowards is not very fossiliferous, but if watched by geologists of the neighbourhood, would, I doubt not, yield many characteristic remains. In my few passing visits with friends and brother naturalists, I have noted various brachiopodous shells, such as the common spirifers, Producti and Rhynconellidæ, both at the Great Doward and above Whithall, near Ross. At the Great Doward I once obtained a portion of a large Ichthyodorulite, or fish spine, shewing that such relics of former life are to be found if searched for. There is a *bone bed* full of fish teeth, and defences, at the base of the carboniferous strata, at Bristol; and Lord Ducie found it at Tortworth; does it exist in the Ross district, and has any one ever searched for it?

The Millstone grit of Dean Forest may be easily mistaken for the Old Red conglomerate, as they are both pebble beds. A little observation, however, will enable the geologist to detect the difference at a glance, as the matrix of the Millstone grit is far more crystalline than that of the other. I observed when I was last in the neighbourhood of Ross, that travelled boulders of Millstone grit, and Old Red conglomerate, also of coal measure sandstone, rested against strata to which they did not appertain, high up on the flanks of the hill above Bishop's Wood house, and towards Howle Green. My attention was drawn to this fact by Mrs. Partridge, of Bishop's Wood, and the attention of residents in the neighbourhood should be directed to these phenomena. Howle Hill, Egypt, and Howle Green are on an outlyer of millstone grit and the lowest coal measures, separated from the equivalent carboniferous strata at Ruardean. The intervening tract thus gives a good example of partial denuda-

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tion. The physical geologist who visits from the Forest of Dean the Blorenge, Pen-cerrig Calch, and the South Wales coal field, the Clee Hills, the Vans of Brecon, and the heights of Gader-vawr, will soon realize the great probability that these distant hills, with strata now widely separated, once formed portions of a regular series of continuous and conformable stratification of Old Red rocks with overlying Carboniferous deposits, and that the mountain limestone, nay, even the coal measures, once stretched far and wide above the plains of Herefordshire. At Mordiford and Fownhope, the upper Silurian rocks of the Woolhope valley are upheaved through the lower Old Red deposits. The hill at the Old Gore is Old Red, and the strata are highly inclined. The northern portion of the Ross district, towards Aconbury and Holme Lacy is interesting only to the physical geologist, who would trace the effect of the upheaval of the Silurian dome of Woolhope in the hills around, and the effects of whole ages of denudation as exemplified in the deep and fertile vales.

NO. 3. THE WOOLHOPE DISTRICT.

This district is intended to coincide, as nearly as artificial boundaries will allow, with the area of the geologically famed Silurian rocks of Woolhope; a tract, which from Tarrington, Dormington, and Mordiford on the north, extends southwards into the County of Gloucester. The main turnpike roads have been made use of as boundaries, since they approach very near to the actual geological limits.

From the borders of Gloucestershire, near the Lea, the western boundary of this district is traced by the continuous line of roads passing Eccleswall Court, Broomsash, Crowhill, Old Gore, Fownhope, Mordiford, Dormington, Tarrington, The Trumpet Inn, and Little Marcle; the remainder of the eastern boundary is formed by the county of Gloucester.

GEOLOGY.—The Woolhope district is one of the most remarkable geological districts in Great Britain. It is an example of the elevation of a large tract of underlying strata, the Upper Silurian strata, through the overlying Old Red strata by earthquake action,

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while all those rocks were beneath the waves of an ocean. The whole of this district may be described as a mass of Upper Silurian strata elevated in the shape of a pear, and extending from Mordiford, four miles from Hereford, on the north, to Gorstley, near Newent, on the south. At Gorstley the Silurian rocks dip for a short distance under the Old Red sandstone, and rise again at Aston Ingham and near Kilcot Green, into the Silurian dome of May Hill.

It is not easy to describe the geological phenomena of this remarkable upheaval and denudation of Silurian rocks briefly and succinctly. I can only say that, I believe, there was a period when the high hills of Seager Hill, Stoke Edith Park, Backbury Camp, and Cherry Hill, near Fownhope, were horizontal stratified Aymestry rocks, overlaid by the Old Red sandstone, and overlying and surmounting the Wenlock rock of Dormington quarries, Hollinghill Wood, and Limekiln Bank, near Fownhope. The Wenlock rocks also overlaid the Woolhope limestone of Woolhope, Littlehope, and Scatterdine; and this limestone again surmounted the Llandovery rocks of the dome-like wood of Haughwood. Earthquake agency upheaved the Silurian rocks into this cone-like form through the Old Red overlying strata; but all these rocks must have been *underneath the sea* at the period of upheaval, for sea-waves and currents have swept away every fragment of the mass of rock that once linked together the continuous strata of Aymestry with Aymestry rock, and Wenlock with Wenlock limestone, and swept out the soft intervening Ludlow and Wenlock shales into deep and nearly circular vales.

Mordiford, at the north of this district, is well worthy of the attention of geologists, as it is the only locality where any amount of debris is collected of the immense masses of rock that have been denuded. Probably a second elevation occurred, and the Mordiford gorge may have been wider than at present. Near to Mordiford are the lower Wenlock limestone (Woolhope limestone) of Scutterdine. These beds are renowned for their fine specimens of the large trilobites, Illænus Barriensis, and Homolonotus Knightii. One specimen I obtained from them, now in the Malvern Museum, is as large as a fair sized lobster. Dr. Wright, of Cheltenham, and the Rev. F. Merewether, of Woolhope, have also secured good specimens.

Dormington *village*, on the Hereford high road, must not be confounded with Dormington *quarries*. The village stands upon

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rocks which constitute a passage between the Old Red and the upper Silurians, in fact is near the line where the Silurian beds are upheaved through the rocks which once overlaid them. Dormington quarries can only be reached by surmounting the hill and passing over the uplifted ridge of Aymestry rock, by Backbury, or the landslip. They are of Wenlock limestone, the valley intervening between them, and Haughwood, being a valley of denuded Wenlock shale. The mansion of Stoke Edith Park, the residence of Lady Emily Foley, stands very close on the line of upcast of the Silurian rocks, as also does Tarrington village, and the Foley Arms Inn. The upper Silurians rising through Old Red rocks, may be seen at many localities on the south of the village of Fownhope. Capler Wood and Nash Tump on the west, Putley, and Little Marcle on the east of Woolhope dome, are on the Old Red.

At Much Marcle the junction of the Old Red and upper Ludlow deposits may again be observed. I accompanied the late MR. STRICKLAND, some years ago, to look for the Ludlow bone bed, which we found at a locality north of the Ross and Ledbury high road, between Lyne Down and Gamage Ford, where our friend and companion, the REV. HENRY STONE, discovered for the first time the seed vessels of the earliest known land plant—the seed vessels of a small Lycopodium. At Gorstley there is a section, near the large pool, shewing the junction of the upper Ludlow beds with the Downton sandstone. The fossils here are interesting. The interior of some of the fossil shells contains spicules of sulphuret of nickel, which the quarrymen of course call "gold." The Lea, at the southern extremity of this district, is situated on the Lower Old Red, and near the junction of the upper Silurian upcast of May Hill. It is chiefly remarkable for its well-restored village church, and a parsonage house of better taste than common.

NO. 4. THE LEDBURY DISTRICT.

This consists of the basin of the little river Leadon, a tract extending from the hills of the Woolhope District to the hills which rise immediately to the east of Ledbury. To this is added the tract intervening between these hills and the Malvern range, which constitute the natural boundary of Herefordshire on the east. Of

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this latter part of the district, the northern part is drained by Cradley Brook—the southern by a tributary of the Leadon. The whole of this district is therefore a backwater of the Old Severn Straits.

The exact boundaries of this district are formed on the north by the Worcester and Hereford road, from its intersection of the County boundary at Holywell turnpike to the Frog and Half-hide, near Castle Frome; from thence the western boundary follows some small roads to Canon Frome, Ashperton, Pixley, Aylton Chapel, and little Marcle, where it meets the boundary of Gloucestershire.

GEOLOGY.—The Ledbury district, as apportioned by MR. PURCHAS, takes in at its northern extremity, the western flanks of the Chase-end and Ragged Stone hills, which constitute the southern end of the Malvern hills. There is no locality along the range of the Malverns so important to the geologist as the section on the Ragged Stone. In the Dictyonema shales at the south end of the Chase-end hill, and the volcanic dykes and black schists containing Oleni, near Fowlet's farm, we have evidence of the great, and, we may say, extreme antiquity of the Malverns, for rocks as old as the Lingula Flags of Wales are deposited upon stratified old gneiss rocks, which were as much hardened and consolidated at the time those Lower Silurian rocks were laid down upon them by Pre-Cambrian waters, as at the present time.

The Middle Lingula Flags are fossiliferous near Fowlet's farm, and have yielded many fossils, trilobites, and small brachiopodous shells, to the researches of MISS MARGARET LOWE, of Great Malvern, and MR. TURNER, of Pauntley. PROFESSOR PHILLIPS was the first to discover these fossils, several years ago. Agnostus, which is an important form of crustacean, for it is a form found in the Lingula Flags of Sweden and America, as well as of Great Britain, was first detected here by the late MR. HUGH STRICKLAND.

Again, we here observe that old lava rocks, have been injected into fissures, and erupted through crevices in the Hollybush sandstones and Black shales. This old lava rock is of considerable thickness, and occupies the physical position of the Llandeilo, and Bala (Caradoc) rocks of Murchison. It is also worthy of remark that the Upper Silurian deposits which were deposited on this volcanic rock, present

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no sign of metamorphism, or alteration by heat, within a few yards of the trap bosses. The May Hill beds appear to have been deposited on the trap floor of the old sea bed after it had become cold and consolidated. Eastnor Park, the demesne of Earl Somers, falls within the district of Ledbury, and there are few finer fields for the geologist.

The oldest known specimen of the Pterygotus, a Silurian lobster, was found in the May Hill sandstone, at the base of the Obelisk hill, by Mr. John Burrow, of Malvern. The developement of Upper Silurian rocks between the Obelisk hill and Ledbury is very fine, and should be followed out by Netherton, and Awkeridge Farms, to Chance's Pitch, and thence to Colwell by Wellington Heath, where the Old Red rocks may be seen flanking the hills of Hope End and the Frith Wood. The railway tunnel at Ledbury, on the western side, enters in lower Ludlow rock. A little distance within the tunnel there is a fault, and the Aymestry limestone is cut through. The Wenlock shale and limestone are then traversed, being nearly in a horizontal position. The Lower Ludlow beds again come in, followed by Aymestry rock, Upper Ludlow shales, Downton sandstone, and, at the west end of the tunnel, by red and mottled marls, grey shales and grits, purple shales and sandstones, with grey grits containing abundance of a little fossil fish termed Auchenaspis, and which constitute a passage into the Old Red sandstone proper, which sets in before we reach the Ledbury Station. Wall Hills Camp near Ledbury, consists of Old Red rocks, with a crystalline cornstone, and bands of red and grey sandstone. At the base of this hill is a thin band of impure grit, and cornstone, containing many fish spines and scales. Henry Brooks, of Ledbury, a working geologist, furnished me with many specimens. Cradley, Castle Frome, Canon Frome, Munsley, and Pixley, are all situate on the Lower Old Red. At Cradley there is a valley *drift* deposit on the line of the brook, but considerably higher than the present water shed. Lias shells were detected in this valley drift by the Rev. R. P. Hill, some years since. The drift was evidently formed in a valley where the waters opened out into the Severn straits. Near Ledbury the valley drifts have furnished fossil bones, and mammoth's teeth, as also at Clincher's Mill gravel pits, near Eastnor. Bosbury, Coddington, and Mathon, are all situated on the

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Old Red rocks, and are far more famed for cider than fossils. The land of the Old Red is, however, infinitely superior to the poor washy clays of the Silurian deposits.

NO. 5. THE BROMYARD DISTRICT.

This district, lying at the extreme N.E. point of the county of Hereford, is bounded on the N. and N.E. by the county of Worcester, the line of separation between the counties being exceedingly irregular and unnatural.

From the borders of Worcestershire to the intersection of the Ledbury and Bromyard road, near Castle Frome, the southern boundary is formed by the Worcester and Hereford turnpike road. From Castle Frome the western boundary is marked by the turnpike road northward to a point near Bromyard, whence, taking a more westerly direction to Bredenbury and Grendon Bishop, it proceeds along the line of watershed, and reaches the borders of Worcestershire near Bockleton. The western part of the tract thus defined is drained by the Frome: the eastern by the Teme and its tributary brooks.

This district is in one respect of great botanical interest, for it is the only part, not only of Herefordshire, but also of Britain, in which the curious plant Epipogium aphyllum, Sw., has been found. This plant is rare and of very uncertain occurrence even in these parts of the continent of Europe which have long been known to produce it.

GEOLOGY.—The Bromyard district consists entirely of lower Old Red clays and marls, with hills of cornstones and sandstones, as at Castle Frome and Bishop's Frome. There are certain quarries between Acton Beauchamp and Castle Frome highly fossiliferous. The rock consists of thin cornstones interstratified with clays and thin-bedded sandstones. One quarry, situate about a mile from the great quarry, at Ridgeway Cross, near Stifford Bridge, is full of fossiliferous remains, the plates, heads, and tails of those remarkable Old Red fish, the Pteraspis, and Cephalaspis. Mr. Gill, the overseer of the Ridgeway quarries, generally possesses some good specimens of the heads and plates of Cephalaspis Lyellii, Pteraspis

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Lloydii, and P. rostratus. Unfortunately the fish are never found entire. It was from MR. GILL that MR. RAY LANKESTER obtained a portion of Pteraspis with the scales attached.

At Acton Beauchamp, my friend MR. HUMPHREY SALWEY, of Ludlow, found a new Cephalaspis, now named in honour of the discoverer, C. Salweyii. I have heard of fossil fish being discovered near Tedstone Delamere, but never saw a plate of one there myself; although near Bromyard I have seen the roads mended with stone containing fragments of Pteraspis. I am not acquainted with the district between Thornbury and Stoke Bliss, but have geologised over the upper part of this district, from Upper Sapey to Stanford. The Old Red is still the rock of the county, but unfossiliferous as far as my experience goes. Mammoth's teeth have been discovered in drift above the Teme, near Stockton, a few miles north of Upper Sapey. I have also seen the teeth of Rhinoceros in the possession of MR. JONES of Cleobury Mortimer, from the Teme gravels.

NO. 6. THE FROME DISTRICT.

Between Steen's Bridge, near Humber, on the west, and Flaggoner's Green, near Bromyard, on the east, the northern boundary of this district is formed by the Leominster and Bromyard turnpike road. From Flaggoner's Green, the eastern boundary follows the Bromyard and Ledbury road, until within five miles of the latter place; it then turns south-westwards, by Canon Frome and Ashperton, to the Ledbury and Hereford road, which it meets at the Trumpet Inn, and follows westwards to Dormington. From thence the western boundary follows the principal roads passing Bartestree Chapel, Withington, Felton, and Bodenham; near which latter place it takes the course of the Humber brook, and returns along its course to Steen's Bridge. The drainage of the eastern side of this district is effected by the Frome and its tributary the Leddow. The western half is drained by small tributaries of the Lugg proper.

GEOLOGY.—The whole of this district is covered by the rocks of the Old Red, but the most interesting portion to the geologist

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is the southern extremity, which includes Shucknall Hill, Weston Beggard, Bartestree, and Wilcroft. Shucknall Hill is a great wedge of Aymestry rock faulted on edge through the Old Red sandstone. At Bartestree there is a dyke of Trap traversing and roasting the Old Red marls and clays into a hard sandstone; while a quarter of a mile farther north, near Hagley House, there is an upcast of uppermost Silurian deposits just appearing at the surface, capped by Downton sandstone, and red marls, as displayed in the Ledbury tunnel. At Weston Beggard the Old Red is quarried. At Wilcroft there is the most instructive section of High level Drift I ever beheld, and I have to thank LADY EMILY FOLEY for directing my attention to this excavation of these gravel beds. The Wilcroft drift is extensively excavated for railway purposes, and occupies a position of a hundred, or a hundred and fifty feet, above the Frome, and existing watersheds. This drift consists of well rounded pebbles of greenstone and Welsh rocks, interstratified with beds of fine sand, in which are *large angular blocks* of Old Red sandstone. We saw one sticking out of the sand, and asked the workmen to disinter the block. It was so large that it took three of us to turn it over; it was sharp and angular at the edges, and evidently had been dropped in the sand as it lay. How but by an ice floe, when every other pebble near was well water-worn and rounded. The men informed us that they had quarried numbers of these great blocks out of the sand, and that some were a ton in weight.

NO. 7. THE HEREFORD DISTRICT.

This consists of the valley of the Wye, from Preston-on-Wye on the west, down to Mordiford on the east, together with a portion of the valley of the Lugg, as high up its course as Bodenham, the whole forming an irregular central plain to the county, and near the middle of which stands the city of Hereford. The actual boundaries adopted are a line from Mordiford westward, by the northern base of Aconbury Hill to Dewsall, following some roads past Thruxton and Kingstone, as far as Tibberton and Preston-on-Wye, returning in a N.E. direction past Byford, Bridge Sollars, Credenhill, Wellington, and Bodenham, to England's Gate. Thence south-eastward to

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Felton, southward thence to Withington, Bartestree Chapel, and Mordiford.

GEOLOGY.—The City of Hereford stands partly on the lower Old Red sandstone, partly upon an alluvial gravel of the ancient Wye; ranges of hills composed of upper Silurian rocks, as the hills of Backbury, Mordiford, and Fownhope, and the Cornstone rocks of the Old Red, as Dinmore, the Pyons, and Aconbury, rising on every side.

This appears to be the place to allude to the drifts of Herefordshire, those relics of ancient rivers, lakes, and even sea straits, which appertaining to the more recent of geological phenomena, belong, nevertheless, to periods which, chronologically speaking, were immensely remote. I have endeavoured, in another pamphlet, to correlate, though I fear roughly and imperfectly, certain of the phenomena displayed by the Worcestershire and Herefordshire drifts;* can only give the briefest notes here.

The examination of the Wye leads me to the conclusion arrived at by Mr. Richardson, C.E., namely, that the Wye has altered its course, and destroyed and reformed its alluvia over and over again, without having encroached upon the land bounding the alluvium, to any appreciable degree, for many past ages.

From the excavations of the Severn alluvium, we infer that there was a time when the Severn flowed, as the river Shannon does now, through a chain of various sized *lakes*. The lacustrine silt has been penetrated in two or three instances, and lies some forty feet below the alluvium of the Severn. The lake silts are full of fresh water shells, fossilized bones, and vegetable remains. The alluvium is nearly wanting in fresh water shells, as the Severn does not cover its alluvial meadows with fresh water shells in its autumnal floods. The bed of a *lake* is a quiet resting place for fresh water mollusks, and there they congregate by thousands. I believe the same history attaches to the Wye, and that, before the present physical conditions obtained, the Wye flowed through a chain of lakes, which were gradually silted up into marshes, until the overflowings of the river raised the alluvium, and constituted the fertile

* Geology of the Railway from Worcester to Hereford. Hardwicke, Piccadilly.

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meadows we now behold. But how often has the Wye again and again shifted the bed of its stream and its shingle beaches, since it first began to deposit its alluvium above the lacustrine silt? My friend, MR. CURLEY, informs me that the lake silt was reached in the sewerage excavations at Hereford, at the depth of thirty or forty feet.

The investigation of the drifts of the Severn and Avon leads us to believe that there was a period when *broader rivers* than the existing Severn and Avon flowed through a chain of broad water lakes upon the Avon, and down a marine estuary of the Severn. These rivers deposited their shingle, and have left their proofs in beds of sand and rolled gravel, twenty feet above the highest flood-mark of the existing rivers. These are the *low level drifts* of MR. PRESTWICH, and they contain in great numbers the remains of the animals that lived upon those river shores. The elephant, the rhinoceros, cave lion, cave bear, hyæna, and others were the denizens of our county.

These drifts of an ancient Wye are developed near Hereford. The Infirmary stands upon their shingle; and MR. DE BLAQUIERE has lately been fortunate enough to find in them a Mammoth's tooth. It is in good preservation, but water-worn. These drifts should be carefully watched.

A hundred or two hundred feet above these *low level drifts*, we find the *high level drifts* of PRESTWICH. In my own district of the Severn straits, I can point to several examples, but never have I seen so really good and interesting a section as at Wilcroft, Lugwardine, which I have already alluded to.* Nowhere have I seen such large boulders imbedded in the drift. We want fossils from these interesting deposits. I have succeeded in procuring a few from the Severn high level drifts, but they were few and far between. They belong to the Mammoth, and the long-haired Rhinoceros. Search, geologists of Herefordshire, and botanists likewise! With aid and observing eyes we do not know what light we may yet throw on these, at present, dim and indistinct records of a byegone age. Search among the drifts of the Wye, the Lugg, and the Arrow!

* Frome District, p. 13.

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The whole of this district consists of Old Red sandstone, but the character of the soil varies. The vallies of the Lugg and Wye are rich, especially that of the Wye, but some of the stiff clays, as about Allensmore, require draining and much culture.

The fossils are rare. A few broken fish spines from the quarries near Hereford, and a tail of Cephalaspis Lyellii, in the possession of the Rev. J. H. Barker, are the only fossils I have ever seen, from the Old Red of this district. Such as they are they indicate the position of the beds as appertaining to the lower series of the Old Red strata.

NO. 8. THE WEOBLEY DISTRICT.

A hilly tract to the N.W. of the Hereford district. It is drained in its S.W. parts by the Wye; in its N.E. parts by Stretford Brook and other lesser tributaries of the Lugg, as well as by the main branch of the Lugg.

Starting from Bridge Sollars, six miles west of Hereford, the boundary ascends the left bank of the Wye, to Willersley; thence it turns N.E. along the road by Kinnersley and Sarnesfield, to Leominster; continuing from Leominster eastward to Steen's Bridge, three miles on the Bromyard road. From this point it turns southward to Bodenham, thence it takes the course of the Lugg, till it approaches the village of Wellington, and returns by some small roads to Credenhill and Bridge Sollars.

GEOLOGY.—This district is remarkable for the number of picturesque and wooded hills which have withstood the denuding powers that hollowed out the vales, and which owe their preservation to the concretionary masses of Cornstone which are imbedded between beds of sandstone and clay, and are used for road purposes. The Pyons, Dinmore, Lady-lift near Foxley, and the hills south and south-east of Weobley, are among the best examples of the cornstone hills of Herefordshire. I have seen fragments of fossil fish, probably Pteraspis, from Dinmore tunnel, on the Hereford and Shrewsbury railway, and also from Wormsley and Brinsop, and have no doubt the quarries of the neighbourhood would furnish a collection to a diligent geologist. I would also call attention to any gravel

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deposits at Monklands that may be quarried. MR. CURLEY has in his possession a worn molar of Rhinoceros tichorinus from the Lug drifts near Dinmore.

NO. 9. THE LEOMINSTER DISTRICT.

A tract extending from the borders of Shropshire on the north, to the Bromyard and Leominster road, and the river Lug, on the south and S.W. The Bromyard road bounding it from Grendon Bishop to Leominster, the Lug from thence to Mortimer's Cross. The turnpike road between Mortimer's Cross and Richard's Castle defines it on the N.W., and a line of watershed running from Grendon Bishop in the direction of Bockleton, in Worcestershire, on the east.

With the exception of a small tract lying north of Berrington and the hamlet of Leyster's Pole, and which pertains to the valley of the Teme, the Leominster district mainly consists of the basins of Stretford Brook, Risbury Brook, and Ridgemore Brook, the chief parts of its drainage reaching the Wye by means of the Lug.

GEOLOGY.—This is a district of Old Red sandstone, but it contains more than one locality where the stones of the quarry glisten with plates that belonged to the enamelled armour that cased the fishes of the Old Red epoch. Leyster's Pole is one of these localities. Heads, tails, snouts, and plates of two or three species of Pteraspis and Cephalaspis abound in these quarries. The REV. J. F. CROUCH, and other members of the Woolhope Club have collected some fine specimens from this neighbourhood. A quarry near Puddlestone is famous for its wave-rippled sandstone, and for tracks of crustaceans, or some such animals, preserved on thin muddy layers that lie between the sandstone slabs. In the Worcester Museum there is a fine slab beautifully rippled, and with the marks of some creature that paddled across the ripples. It was left me, as a last token of kindness, by my departed friend, the REV. T. T. LEWIS. The Cornstones of Kimbolton, and the hills east of Leominster, are fossiliferous, and contain many plates of fish.

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NO. 10. THE AYMESTRY DISTRICT.

This consists of the extreme northern angle of the county, and belongs partly to the valley of the Teme, and partly to that of the Lug. Its boundary may be roughly described as a line from Richard's Castle, on the borders of Shropshire, on the east, to Presteign, on the borders of Radnorshire, on the west. To speak more exactly, from Richard's Castle, three miles south of Ludlow, this line takes a S.W. direction along the principal road to Mortimer's Rock, thence it proceeds westward along the line of highest ground to Byton Cross, from which point it takes the turnpike road to Presteign. It has been intended to embrace in Districts 10 and 11 the tracts occupied by the Silurian rocks, so far as was consistent with the adoption of boundaries which might readily be found.

GEOLOGY.—This most interesting district requires a long chapter of explanation, rather than a few brief notes. Such however, is beyond the scope of the present work. The Silurian districts of Ledbury, Woolhope, May Hill, and Usk are Silurian masses uplifted through the Old Red rocks, and are surrounded, or nearly so, by the deposits through which they have been faulted. At Ludlow, Aymestry, and Kington, however, the Silurian strata prevail far and wide towards the west, and if it were not for certain outliers of Old Red sandstone near Clun, Presteign, and Radnor, we might doubt whether the Old Red had been deposited above the Upper Silurians of this district. However, there is no doubt upon the subject, for in some instances patches of the Old Red rocks have been borne up upon hills of Silurian rocks, and preserved from denudation. Indeed we may be sure that the Old Red sandstone was once continuous from Herefordshire to the Long Mountain, and North Wales.

The Aymestry district takes in Ludford, though not Ludlow. Too much cannot be said of the perseverance of the Ludlow Geologists, with Col. Colvin, Mr. Lightbody, and Mr. Salwey, as their leaders, or of the admirable local museum which has sprung up under their auspices. The discoveries made by these gentlemen, and their coadjutors, Messrs. Marston, Pardoe, and others, have added great interest to the geology of Siluria and the Old Red Sandstone. The note I give for my readers respecting the Ludford and Ludlow district, is "Go to the Ludlow museum, and ask for information from the Ludlow naturalists."

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Leintwardine and Burrington are interesting districts for the geologist, and many beautiful Silurian fossils are to be obtained there—such as Star-fishes and Trilobites. Leintwardine furnished one of the most important fossils ever discovered. There was formerly a prevailing notion among geologists that they had detected the precise period, in past geologic epochs, when fishes were created, and that this period was during the deposition of the uppermost Ludlow strata, the well-known "bone-beds." They were mistaken, for MR. LEE, of Caerleon, a member of the Woolhope Club, found the remains of a fish at Leintwardine, in the *lower* Ludlow deposits; and these lower Ludlow beds are many hundreds of feet lower than the bone bed of the Upper Ludlow rocks.

At Pedwardine, near Brampton Brian Park, there is a remarkable section, shewing the Lingula flags uplifted, and containing Dictyonema sociale, and a small Obolella. These beds are precisely similar in mineralogical character, as well as in fossil remains, to those detected some years ago on the south-western flank of the Malvern Chase End. The beautiful scenery of Croft Ambrey, and Shobdon with its ruined Church, come within the Aymestry district. Therein we have Wigmore Castle, and Leinthall Earls, and many other localities most interesting to the archæologist, botanist, and geologist. Lucton, at the extreme edge of the district, is close on the junction of the Old Red and upper Silurian rocks. The trap of the Clee Hills is no doubt a portion of the Plutonic agent that uplifted the Silurian rocks of this district. Aymestry was for many years the residence of the discoverer of the fossils of the "Silurian System," the REV. T. T. LEWIS. He it was who, with DR. LLOYD of Ludlow, first correctly established the divisions of the Upper strata, and collected the fossil remains of the Old Red and Upper Silurian deposits. He communicated his discoveries to SIR RODERICK MURCHISON, who was then indefatigably engaged upon the investigation of the rocks of Siluria; and we possess the result in those standard English volumes, "The Silurian System," and "Siluria," works of which not only the author, but the English nation, may be justly proud.

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NO. 11. THE KINGTON DISTRICT.

This consists chiefly of the upper basins of the Arrow, and of Backbrook, one of the tributaries of the Lug.

From Mortimer's Rock, near Mortimer's Cross, its south-eastern boundary follows a nearly straight course through Shobdon village to Lyonshall. From this point it takes the line of highest ground westward until near Michaelchurch it meets with the boundary of Radnorshire. The county of Radnor bounds it on the west and north-west to Presteign. The northern boundary may be roughly taken as a line from Presteign to Mortimer's Rock; whilst more strictly it may be described as following the turnpike road from Presteign and Byton Cross, thence taking the line of highest ground along Shobdon Hill wood, descending from thence to Mortimer's Rock.

GEOLOGY.—The Kington district is nearly as interesting as that of Aymestry, and would be more so if we could include a few square miles to the west, and appropriate the Trap district of Stanner Rocks and Hunter Hill, and the metamorphosed Upper Llandovery rocks of Old Radnor. Kington, like so many other small towns and villages of Herefordshire stands on or near the junction line of the Old Red rocks and the uppermost Silurians. My friend, MR. RICHARD W. BANKS of Ridgebourne, rendered important service to Silurian and Old Red geology, by detecting in the Passage beds between the Old Red and Silurian systems a series of fossils that proved beyond a doubt that fossils are not so distinctly characteristic of particular formations as they were formerly supposed to be. The Passage rocks between these two systems of rock deposits have lately furnished to the investigation of geologists organic remains of animals which evidently existed both in the Upper Silurian and Devonian times. The Pteraspis is found in the Lower Ludlow rocks, and ascends high into the Cornstone strata, while one or two species of Cephalaspis occur as low down as the passage rocks, or Tilestones of MURCHISON.

There are quarries of fine building stone at Penhros, near Kington; and the Lower Old Red of Kingswood contains the same Lingula as the Auchenaspis passage beds at Ledbury. There is an outlier of Old Red resting on the Upper Silurians at Park Wood, near Kington, and again at a place called Little Foyce, south of Gladestry, and west of Huntington. The *boulder rocks* of the Huntington district require attention and investigation. Knill, and Knill Garraway near

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Offa's Dyke, the partially metamorphosed Woolhope Limestone of Nash Scar, resting against highly fossiliferous Llandovery sandstone; and the outlying Old Red rocks of Upper Radnor wood, are all worthy of the investigations of the geologist.

Near Staunton-on-Arrow there is an alluvial flat, probably the site of a former lake silted up by the Arrow and other mountain streams.

NO. 12. THE PEMBRIDGE DISTRICT.

This is a level and rather narrow strip stretching in a north-westward direction from the left bank of the Wye, where it first enters Herefordshire, to the river Lug, which forms its boundary between Mortimer's Cross and Leominster. The hills of the Kington district form a natural boundary on the north and north-west, as do those of the Weobley district on the south-east. The road from Leominster to the Hay is taken as an approach to this natural boundary on the south-east. The river Wye has already been mentioned as the southern boundary. The western limit is, of course, the county of Radnor. From the neighbourhood of Michaelchurch, in Radnorshire, a line of roads through Lyonshall, Staunton-on-Arrow, and Shobdon, defines the north-western boundary, which rejoins the Lug at Mortimer's Cross.

GEOLOGY.—This district is altogether on the Lower Old Red, as Mr. Purchas draws his lines of demarcation. The only subject of interest to the geologist, that I ever met with in this neighbourhood, is the collection of Old Red fish remains and other fossils, in the possession of the Rev. J. F. Crouch, the Rector of Pembridge. I believe Mr. Crouch has a few Old Red fossils from the strata of the neighbourhood, from a locality near Shobdon, where the Silurian rocks rise through the Old Red to the high grounds of Shobdon Park.

NO. 13. THE GOLDEN VALLEY DISTRICT.

This consists principally of the Golden and Grey Vallies, with the ranges of hills on either side, thus extending from the Wye at Whitney and Willersley, southward to the Worm brook, and from Thruxton and Tibberton, westward, to Cusop Hill and the hills east of Michaelchurch Escley. Owing to its being thinly populated and little traversed, it is difficult to fix on artificial boundaries, such as

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lines of road in this part of the county. The actual limits fixed for this district are—on the north, the Wye from Clifford to Preston-on-Wye, from thence a line taking a south-east direction by some roads passing Kingston and Thruxton, to Willock's Bridge farm, as the extreme eastern angle. From thence the course of the Worm brook to Pontrilas, as the south-western angle. From Pontrilas the course of the brook is followed north-westward to Ewyas Harold and Dulas; from which latter place the western boundary is continued by a line drawn along the slope of Cusop Hill to Hardwick and Clifford. Owing to the formation of the ground, and other causes, it is difficult to fix on a satisfactory western boundary for this district, although the district itself is tolerably natural, since it consists of ranges of hills, with intervening vallies running parallel with the ranges of the Hatterel Hills or Black Mountains to the westward; yet intermediate in character, elevation and climate, between these and the lowlands near the Wye on the east.

GEOLOGY.—This may be described as a district of Old Red strata of hills of Cornstones, and sandstones, and denuded vallies. It possesses some important features for the physical geologist, and sundry boulder rocks that rest on high elevations on the flanks and summits of the hills below the Black Mountain, deserve our especial attention. The more I examine into the history of these masses of transported rock, and the masses of Trap and boulders of Llandovery conglomerate on Bradnor Hill, and other hills around Kington, the more I feel assured that these rock masses were deposited when the summits of hills as high as Merbridge and Bradnor were beneath a sea traversed by ice-bergs and ice-floes transporting those rock masses.

NO. 14. THE BLACK MOUNTAIN DISTRICT.

This consists of the extreme western portion of our county, and, as the name given to it will shew, it contains within its area such portion of the Black Mountain ranges as belongs to Herefordshire. It is separated from District 13 by the line from Pontrilas to Clifford, which was mentioned as the western boundary of that district. The remainder of its outline is defined by the borders of the adjoining counties.

On the second range of the Black Mountains, reckoning from

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east to west, there is an outlying part of Herefordshire, called the Ffwddog; it is between five and six miles in length, and one in breadth at its widest part. A small portion of the county of Monmouth—the valley of the little river Honddu, or valley in which stands Llanthony and its Abbey, intervenes between the Ffwddog and the main area of Herefordshire; but as the Ffwddog is of some extent, and as its greatest distance from the parent county amounts scarcely to three miles, it has been thought better to extend the limits of the present district so as to include both the Ffwddog and the intervening portion of Monmouthshire. By this means we are enabled to include in our list the names of some few plants recorded from the vicinity of Llanthony, but whose localities were given too vaguely to make it clear to which county they in strictness belong. By the present arrangement this uncertainty is removed, and the plants belong unquestionably to the district to which this Flora relates.

Whilst, however, a part of Monmouthshire has thus been appropriated to District 14, and another outlying portion of the same county adopted into District 2, there are several outliers of our own county which are left to be appropriated by botanists of the adjoining counties; these are

1. A small pièce of ground on Devauden Hill, Monmouthshire.
2. A larger portion between Cascob and Whitton, Radnorshire.
3. Another of about two square miles near Rochford, on the left bank of the Teme, about one mile and a half to the east of Tenbury, is physically a part of Worcestershire, and to the able botanists of that county we commend the examination of its plants.
4. Farlow, the largest outlier (from two to three square miles), is situated at the north-eastern base of the Titterstone Clee Hill, in Shropshire.

Whitecliff, on the right bank of the Teme at Ludlow, lies within the boundary of Herefordshire, but the Sedum reflexum and other plants which grow there have, like the plants of Farlow, been included in the Rev. W. A. Leighton's "Flora of Shropshire." In order, therefore, to avoid misleading others by including the same station within two county Floras, the Sedum and other Whitecliff plants are omitted in this "Flora of Herefordshire."

GEOLOGY.—There are certain physical and geographical fea-

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tures in geology which it is impossible to condense, and the student must make up his mind, if he would understand them, to become thoroughly acquainted with the phenomena themselves. In notes necessarily so brief as these, we can do nothing but give a few hints respecting the most striking of the wonders presented to our investigation, and then ask the geologist to pass onwards and to observe, record, and theorise for himself.

The geological history of the Black Mountain district cannot be described, it must be studied. I can but reiterate here what I have endeavoured to impress, at greater length, in another treatise,* statements of which the proofs are difficult to express in words, but of the truth of which I am firmly convinced.

The strata on the summit of the Black Mountain are the beds of the Upper Old Red Sandstone. These strata formerly extended far over the highest Cornstone hills of Herefordshire; over the Silurian rocks of Kington; over the vales to the distant Clees and Malvern; over Dean Forest and the Severn at Tortworth.

The outliers of the South Wales Coalfield, the Carboniferous rocks at the Forest of Dean, Pen-cerrig Calch, the Clees, reveal that over a great portion of this Upper Old Red district, the Carboniferous rocks must have been deposited, and the physical geologist who stands upon the summit of the *Gadir Vawr*, that point of the Black Mountain that rises high above Talgarth, and stands out a monumental witness of the wonders of geology, knows that even above that mountain peak there was once piled a mass of sedimentary deposits, themselves formerly the bed of an ocean.

At Cusop, near Hay, the grey Sandstones that overlie the Cornstones are quarried for building stone. They contain remains of plants, and the equivalent rocks, near Kentchurch, at the summit of Rowlstone hills, have furnished the only fossil, a Stylonurus, that has been hitherto discovered in beds so high up in the Old Red rocks of Herefordshire, with the exception of the Upper yellow sandstones of Farlow, in which Mr. G. Roberts and Mr. Baxter, of Worcester, detected the remains of Pterichthys and Holoptychius. I mention these Farlow Sandstones as I perceive that Farlow is an outlying portion of Herefordshire.

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* "Old Stones."

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I recommend the route from Talgarth viâ The Gader, by Pencerrig Calch to Llanthony, Longtown, Rowlstone, to the Station at Pontrilas, for the study of any Geologist who loves the physical grouping of rocks, and the lore communicated by a hill-top and a mountain stream. If this investigation of geological wonders does not make him a lover of the physical revelations of our science, nothing else will!

> "A primrose by the water's brim,
> A yellow primrose is to him,
> And t'will be nothing more."

To those who can appreciate such history I wish all success, and part with one word of warning. Do not be induced to overwork either your legs or your brains. Fifteen miles a day of hill-side walking, with the necessary geological investigation, is enough for the heartiest and the healthiest. Lastly, don't sit up poring over your notes and sections when you ought to be in bed and asleep.

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SUMMARY

OF THE

FLORA OF HEREFORDSHIRE.

EXPLANATION OF SIGNS EMPLOYED.

In the column of Names of Species:

A dagger (†) prefixed to a name indicates that the plant is possibly—an asterisk (*) that it is probably—and the name itself printed in Italics, that it is certainly introduced in most of its recorded stations.

In the columns of Figures:

(†) indicates probably, and (*) certainly introduced in that particular district.

A note of interrogation (?) accompanying the Name of a Plant or the No. of a District, indicates that there is some doubt either as to the Plant being the true one, or of its having really occurred in that particular District.

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TRANSACTIONS

OF THE

WOOLHOPE

NATURALISTS' FIELD CLUB.

(ESTABLISHED MDCCCLI.)

1866.

"HOPE ON—HOPE EVER."

HEREFORD:
PRINTED AT THE TIMES OFFICE, MAYLORD STREET.
MDCCCLXVII.

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Woolhope Naturalists' Field Club.

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VICE-PRESIDENTS:

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C. G. MARTIN, Esq., Hereford.

ELMES Y. STEELE, Esq., Abergavenny.

HON. SECRETARY:

The Rev. G. H. CORNEWALL, B.A., Moccas Rectory, Hereford.

ASSISTANT SEC. AND TREASURER:

Mr. ARTHUR THOMPSON, Hereford.

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Rev. W. H. Purchas, Falkner Street, Gloucester.

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The President of the Warwickshire Naturalists' Field Club.

The President, Vice-President, and Hon. Secretary of Worcestershire Naturalists' Club.

The President, Vice-President, and Hon. Secretary of the Oswestry and Welshpool Naturalists' Field Club.

The President, Vice-President, Curator, and Hon. Secretary of the Dudley and Midland Geological and Scientific Society and Field Club.

The President, Vice-Presidents, and Hon. Secretary of the Severn Valley Field Club.

The President, three Vice-Presidents, and Hon. Secretary of the Caradoc Field Club, Shropshire.

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Stanhope, Rev. B. L. S., M.A.
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Weare, Rev. T. W., M.A.
West, Rev. T., M.A.
Woodhouse, Rev. T., M.A.

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NEW MEMBERS ELECTED DURING THE YEAR

1866.

HONORARY MEMBERS.

Edmunds, Flavell, Esq.

Lingwood, R. M., Esq., F.G.S., &c.

ORDINARY MEMBERS.

Banks, Wm., Esq., F.S.A.
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Collins, John Stratford, Esq.
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Jones, Rev. J. Edward.
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Reaveley, Rev. F. Fenwick, S.C.L.
Southall, Mr. Henry.
Styles, R. H. P., Esq.
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Vaughan, James, Esq.
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Williams, Captain.
With, Mr. George.
Wood, J. H., Esq.
Wynne, N. S., Esq.

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RULES

OF THE

WOOLHOPE NATURALISTS' FIELD CLUB.

I.—That a Society be formed under the name of the "WOOLHOPE NATURALISTS' FIELD CLUB," for the practical study, in all its branches, of the Natural History of Herefordshire and the districts immediately adjacent.

II.—That the Club consist of Ordinary Members, with such Honorary Members as may be admitted from time to time; from which number a President, four Vice-Presidents, Treasurer, Honorary Secretary, and Assistant Secretary, be appointed at the Annual Meeting to be held at Hereford in the early part of each year.

III.—That the Members of the Club shall hold not less than three Field Meetings during the year, in the most interesting localities for investigating the Natural History of the district. That the days and places of such regular Meetings be selected at the Annual Meeting, and that fourteen days' notice of each be communicated to the Members by a circular from the

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Secretary; but that upon a requisition being signed by the President and five Members, the Secretary is empowered, upon urgent occasions, to alter the days of such regular Field Meetings, and also to fix Special or Extra Field Meetings during the year.

IV.—That those Members to whom it may be convenient, shall breakfast together at the nearest country inn, at Nine o'clock, after which the researches of the day shall commence.

V.—That Four be the hour appointed for Dinner after which any papers shall be read by the respective authors. Each Member may introduce a friend on such occasions, who must pay his own expenses.

VI.—That the Annual Subscription be Ten Shillings, payable on the 1st of January in each year, to the Treasurer, or National Provincial Bank, Hereford, to be laid out in defraying the cost of Printing such Papers as may be selected for that purpose by a Committee of five Members, chosen at the Annual Meeting from the general body, and to meet any expenses which may be incurred for stationary, postage, &c. That the cost of any lithographic or other illustrations be defrayed by the author of the paper for which they may be required.

VII.—That the papers of the Club be printed in a cheap octavo form.

VIII.—That at the Annual Meeting, the President be requested to favour the Club with an address, containing a written summary of its proceedings at the several Field Meetings during the previous year, together with such observations from himself as he may deem conducive to the welfare of the Club, and the promotion of its objects.

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IX.—That all Candidates for Membership shall be proposed and seconded by existing Members, either verbally or in writing, at any Meeting of the Club, and shall be eligible to be ballotted for at the next Meeting, provided there be FIVE Members present; One blank ball in THREE to exclude.

X.—That Members finding rare or interesting specimens, or observing any remarkable phenomenon relating to any branch of Natural History, shall immediately forward a statement thereof to the Honorary Secretary.

XI.—That the Club undertake the formation and publication of correct lists of the various natural productions of the County of Hereford, with such observations as their respective authors may deem necessary.

XII.—That Members whose subscriptions shall remain for *three* years in arrear, be held to have withdrawn, and their names shall accordingly be omitted from the list of Members at the ensuing Annual Meeting.

XIII.—That the Assistant Secretary do send out circulars, one month at least before the Annual Meeting, to all Members who have not paid their subscription, drawing the particular attention of all those that may be effected by the operation of Rule XII, to that Rule.

XIV.—That these Rules be printed, and a copy sent to each Member.

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"This our Life, exempt from public haunt,
Finds Tongues in Trees, Books in the running brooks,
Sermons in Stones, and good in everything."

Shakspere.

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THE REMARKABLE TREES
OF
HEREFORDSHIRE.

THE SOUTH-EASTERN YEW TREE AT CUSOP, NEAR HAY.

(Taxus baccata, fœm.)

MAY, 1867.

This fine luxuriant tree is one of the four trees in Cusop Churchyard, standing N.E., S.E., N.W., and S.W. of the Church. It has a sound and solid bole. The card of the Club (1ft. by 6in.) is placed at three feet from the ground. Immediately below the green twigs at 3ft. 10in. the circumference of the trunk measures 21ft. 10in., but at one foot from the ground it measures 18ft. 4in.

(Ladmore, Photographer to the Woolhope Naturalists' Field Club.)

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ADDRESS OF THE RETIRING PRESIDENT,

(DR. BULL,)

READ AT THE ANNUAL MEETING. TUESDAY, FEB. 26, 1867.

GENTLEMEN,—One last duty remains for me before I quit this presidential chair. I have to review as briefly as may be the progress of our Club during the past year, and think I may confidently appeal to you to bear me witness that that progress has been most pleasant and satisfactory. Our excursions have been favoured with the brightest and most cheerful weather. The attendance both of members and visitors has been unusually large. The papers and addresses have been remarkable for their number, their interest, and the ability they displayed. But more than all this, the Woolhope Club has this year accomplished one of the primary objects for which it was originally formed. The first part of the Flora of Herefordshire is now printed, and ready for distribution to the members. This part contains a list of the flowering plants and ferns of Herefordshire, showing the part of the county in which each species has been observed; a map of the county, divided into botanical districts corresponding with those in the table of species; an exact statement of the boundaries of each district; and a full description of its geological characteristics. We have thus before us, for the first time, a general view of the Botany and Geology of Herefordshire.

The able and painstaking author of this Flora, the Rev. W. H. Purchas, has been at work on it for many years. His minute accuracy, and his laborious perseverance, have been unwearied, and deserve our warmest gratitude. His labours reflect a lustre, not

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only on our Club, but on the county at large, which now sees its Botanical treasures put on permanent record. In some districts of the county this list is, after all Mr. Purchas's endeavours, exceedingly imperfect; and no one is better aware of this than Mr. Purchas himself. But living as he has done for so many years out of the county, and incessantly occupied with the higher duties of his profession, his progress has necessarily been slow, and he feels that the assistance of other members of the club is required to work out effectively the more distant parts of the county. For these reasons he has kindly yielded to the wish of the club that the first portion of the work should be printed without further delay. We shall then be in a position to render him effectual help; for we shall see exactly what districts want exploring and what blanks yet remain to be filled up before the list can be considered in any way complete. Personal observation is the only means of ascertaining what our Flora really is, and how it is distributed. Is it too much to ask those of our members who take an interest in Botany to note down the plants they meet with, and the localities in which they are found?

The Geological description of the several districts has been written by the Rev. W. S. Symonds, president of the Malvern Club, and one of our honorary members. He has conferred a great favour on the club by this series of very interesting sketches, which, taken together, present the most accurate description of the Geology of the country that has yet been published.

We have also the satisfaction, this year, for the first time, of placing on record a list of Herefordshire Lepidoptera for two districts of the county, amounting together to 546 separate species. For this list the club is greatly indebted to the family of the Rev. Thomas Hutchinson, M.A., of Grantsfield, near Leominster, and to Mr. Alfred Purchas, of Ross.

At the beginning of the year an inquiry was commenced as to the exact size and condition of "the more remarkable trees of Herefordshire" at the present time; and circulars were distributed through the county for information with regard to them. The result thus far obtained, besides many observations for future use, has been the very excellent paper on "Herefordshire Yew Trees," by the Rev. Thomas Woodhouse, M.A., which will appear in the Transactions, illustrated by photographs of the yew trees of Peterchurch,

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Leinthall, and Cusop. It is intended to persevere with this subject, and to present to the members a valuable series of pictures of the trees themselves in the successive volumes of Transactions.

To come now to the more ordinary proceedings of the year. The club, by an arrangement with the proprietor of the *Hereford Times* newspaper, decided for the future to publish a full account of its meetings in that paper. The type was afterwards to be re-set in octavo shape for the Transactions. This arrangement was made immediately after the Talgarth meeting, and has been fully carried out. The duties of your President, therefore (as defined by Rule VIII.), have been considerably lightened. I have now simply to notice this change and give the reasons which induced the club to adopt it.

It might seem frivolous, at first sight, to give a more permanent form to the common incidents of our excursions. It is not really so, for independently of the associations, which this account in its freshness will carry with it to all who were present at the meetings, this plan entirely removes every objection to the publication of the papers read; and thus, set in this simple framework, papers of much local interest have been preserved, which would otherwise have been lost. Our Transactions this year will contain no less than nine addresses and papers on Geological subjects, five on Botany, and five on Entomology and other general subjects. It is not my intention, nor would it become me to criticise these papers, but I should not do justice to them nor to myself, if I did not express my belief that our volume of Transactions this year will not only be a credit to our club, but will also prove a valuable contribution to the Natural History and scientific knowledge of the County.

The full publication of all our proceedings and papers has moreover proved a most successful means of calling public attention to the objects for which the Woolhope Club was formed; of spreading more widely an interest in the natural productions of our county; and therefore of actively promoting the study of natural science in the district. Gentlemen, it seems to me that this too is a result on which we can look back with satisfaction. The published reports of our "field days" make people wish they had been with us. The excursions themselves furnish us with a delightful recrea-

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tion. We are taken into scenes always of great interest and often of great beauty. Hill and dale, rock and meadow, not only yield fresh spoils for the vasculum and the hammer, but they refresh our eyes and banish from our thoughts many of those corroding cares of which busy life is full. Varied as our occupations are, different as may be our lines of thought, here we find one pursuit in which all can take interest, one pleasure which all can enjoy. Natural science affords a common ground on which those can meet in pleasant intercourse who might otherwise never meet at all. There is room in it for the exercise of the loftiest powers of intellect; there is room also for the humbler gifts that fall to the lot of most of us. None can venture to despise it as beneath him; none need shrink from it as above him. So long as "Truth" is the object the student keeps stedfastly before him, he need not fear that his researches will be idle, or his toil without reward. The practised eye, the quickened ear, the keener exercise of all the faculties of observation, are in themselves no small gain. Yet even this is less valuable than the effect which such pursuits,—honestly and rightly followed,—have upon the mind and heart. The order and harmony of outward nature,—imperfectly appreciated perhaps at first—shine out upon the observant eye with ever increasing clearness; and the heart is made conscious of the presence everywhere of one great beneficent Power, the Author of all that beauty, the Promulgator of all those marvellous laws, the Sustainer of the universal fabric. Bowing before His unsearchable Majesty, the student is drawn upwards towards Him; low aims and mean desires, and the hurry and turmoil of this world's strife and troubles, have less and less effect upon him as he traces everywhere the handiwork of the Great Artificer perfect in wisdom and in goodness.

"Thus the men
Whom Nature's works can charm, with God himself
Hold converse; grow familiar day by day
With His conceptions, act upon His plan,
And form to His, the relish of their souls."—*Akenside.*

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THE REMARKABLE TREES
OF
HEREFORDSHIRE.

THE MISTLETOE-OAK AT EASTNOR.

APRIL, 1867.

This well-known tree is situated by the side of the drive leading from Eastnor Castle (The Right Hon. The Earl Somers), up the Ridgway towards the Herefordshire Beacon,—about 400 paces from the Park Lodge, on the left-hand side. The oak *(Q. pedunculata)* is certainly more than 100 years old, and at five feet from the ground from the ground has a circumference of 5ft. 3in. Earl Somers himself was one of the first to observe the Mistletoe upon it many years since. It grows freely upon the tree. The three most luxuriant branches are about thirty feet from the ground, near the main stem, and in each instance the oak branch is killed beyond the place where the Mistletoe is situated. It grows also in four other places on the tree, and has indeed taken thorough possession of it. The card of the Club (1ft. long by 6in. deep) is here placed at 4ft. from the ground.

(Ladmore, Photographer to the Woolhope Naturalists' Field Club.)

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The Woolhope Naturalists' Field Club.

MEETING AT TALGARTH,

MAY 24TH, 1866.

The first field meeting of this club for the season took place on Thursday, May 24th, at Talgarth, under the most auspicious auguries. Dr. Bull, of Hereford, the appointed president of the year, like a wary general, determined to survey the ground previous to its occupation by his troops, provide against any untoward event, and see that the commissariat was duly arranged. In company with a brother naturalist, he accordingly proceeded to Llynsafeddan, or as more commonly called Llangorse Pool, Breconshire, and the lake was most successfully trolled for pike, eight or ten of those "tyrants of fresh waters" being safely hauled in, with a fair show of perch and eels. These were safely stored for conveyance to the Ashburnham Arms at Talgarth, and the worthy hostess served them up at the banquet the next day in a most creditable manner; the largest pike being a five pounder, that had required all the art of the skilful president, in his character as a fisherman, to subdue. But we must now take the events of the day in order.

The weather, if not all that could be wished—for the wind was perhaps a little too rough for the lake—was yet brilliant at times, and fair throughout, just as Barham describes in the "Ingoldsby Legends":—

> The sun shone bright upon tower and tree,
> And the meads were as green as green may be,
> The dear little dickey-birds caroll'd with glee,
> And all was love and harmony.

So the start was made from the station at Talgarth by half-past eleven o'clock, when nearly fifty gentlemen had assembled, and carriages, rather closely packed, conveyed them on the appointed route. A bill of promise seldom carries out all its events, and so it was on the present occasion. Geology, botany, and ichthyology had all to be attended to, "including carriage, boat, and dinner;" and how was all this to be done in the time? It was clear that something must be left out "in the representation," as players say, and Dr. Bull wisely judged that two fortresses could not be carried on the same morning, so "Castle Dinas" was only summoned to surrender, and the main force was directed against the lofty mountain called "Mynydd Troed."

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The members of the club present were: the President, Dr. Bull; the Vice-presidents, the Rev. H. C. Key, Stretton; C. G. Martin, Esq, Hereford; Dr. McCullough, E. Y. Steele, Esq., and Master Steele, Abergavenny; the Honorary Secretary, the Rev. G. H. Cornewall, Moccas, and the Assistant Secretary, Mr. Arthur Thompson; E. Lees, Esq., F.L.S., &c., Vice-president of the Worcester and Malvern Clubs; Arthur Armitage, Esq., Dadnor; T. Cam, Esq., and T. Curley, Esq., Hereford; Richard Hereford, Esq., Sufton Court; J. E. Lee, Esq., Caerleon, Monmouthshire; J. Griffith Morris, Esq., Hereford; H. Salwey, Esq., and Mr. T. J. Salwey, Ludlow; the Revs. Robt. Hereford, Sutton; W. Jones Thomas, Llanthomas; J. H. Jukes, Preston Wynne; H. W. Phillott, Staunton-on-Wye; C. Smith, Tarrington; and Thos. Woodhouse, Hay; and J. E. Smith, Esq., Hay; with William Aston, Esq., T. T. Davies, Esq., H. C. Hurry, Esq., R. P. Styles, Esq., F. Thomas, Esq., and N. S. Wynn, Esq., Hereford; J. Stratford Collins, Esq., Wythall, Ross; Dr. Grindrod, Malvern; Joseph Joseph, Esq., Brecon; — Nash, Esq., Ludlow; Mr. Blashill, Bishopstone; and the Revs. S. Clark, Bredwardine; J. Davies, Moorcourt; H. Dew, Whitney; — Dumbleton, Brecon; W. D. V. Duncombe, Allensmore; W. C. Fowle, Ewyas Harold; W. P. S. Stanhope, Holm Lacy; H. J. W. Stillingfleet, Clehonger; H. W. Tweed, Bridstow, Ross; and R. H. Williams, Byford.

As already stated, a stage coach and several carriages awaited the arrival of the train from Hereford at the Talgarth station, and at once conveyed the members up a gradual ascent of some three miles length to the foot of the Mynydd Troed. Here leaving the fosses and mounds of Castle Dinas to the left, the gentlemen at once began the ascent. The mountain is very steep on this side, and the want of rain had made the ground hard, and the grass dry and slippery. The party were soon scattered over the face of the hill, each taking the direction he most fancied. It seemed easy to begin, but like a true mountain, for the first twenty minutes, the higher you got up the further off seemed the top to be. By perseverance, however, most of them had reached the summit a few minutes before one o'clock, and had opened and spread out before them, perhaps, the most varied and extensive view afforded by the Black Mountains. The Mynydd Troed is the most westerly point of the range, and stretches out boldly into the valley much further than its neighbours. The views throughout the ascent had been very fine, but that from the top far surpassed them. Looking eastward towards the Black Mountain across the valley, up the gorges, and over Mynydd Llysian, the square top of the Gadr-fawr was seen—this is the highest point of the range, 2,545 feet above the sea level—further east still, the long ridge of the Pen-cerrig-calch, then the round back of the Mynydd Llangorse. To the south, the lake of Llangorse, or Llynsafeddan, lay at the foot of the mountain, over it the beautiful hill, the Allt, close to the lake, and over that again the Toryfoet; then came the beautiful outline of the Breconshire Beacons, and further beyond still, the Carmarthenshire Van was plainly visible; whilst to the west and north you overlooked the numerous hills of Breconshire, &c. The

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wind blew very coldly on the top, and the President therefore took his seat a little below the summit, on the south side, and the members soon began to cluster around him like a swarm of bees.

"It was very gratifying," he said, "to see so good an attendance at this the first meeting of the year, and he congratulated all present on the fine weather they had to enjoy such beautiful scenery. He trusted the recollection of the day would be a bright spot in the memory of all present. The Rev. Henry Griffiths, Dean of Queen's College, Liverpool, was to have been present at this meeting, and he regretted very much that he had been unavoidably prevented from coming. But though he could not come himself, rather than disappoint the club, he had sat down to his desk—fancied himself to be where we are now placed—and at one sitting wrote off this paper. Though a written paper, therefore, it was fair to consider it an extempore address. He felt called upon to say thus much in explanation, because Mr. Griffiths had thrown in here and there an apology, which he did not intend to read. He put them in parentheses for omission, and, to say the truth, he did not think them in the least necessary." Dr. Bull then read the paper.

MYNYDD TROED, BRECONSHIRE, MAY 24, 1866.

Gentlemen of the Woolhope Club,—Our standpoint at the moment is one of the upper beds of the so-called Devonian series. Taken in mass, these rocks represent the long period which elapsed between the deposition of the Silurian, seen to the N.-West at Corn-y-Fan, and the millstone grit, to the S.S.-East, on the hills of Llangynider.

In other parts of the kingdom they form a succession of hard calcareous or slaty rocks, of nearly all the colours in the rainbow, and abounding in fossil shells and corals. Here, they are however, best known as constituting the Old Red Sandstone System, of which the following subdivisions are commonly accepted by geologists.

On passing out of the Ludlow rock we come to a marked change, not less in the lithological character of strata than in the general cast of their organic contents. Ordinarily, however, there is no absolute break, but a rapid transition, so rapid as to be instantly felt, yet so gradual as often to render it extremely difficult to draw the exact line of demarcation.

First then, come the TILE STONES: consisting of finely laminated, hard, reddish or greenish micaceous sandstone, which readily splits into flags, with occasional beds of a dull red shale. Magnificent sections may be seen in the gorge of the Teme, and especially in the valley of Cwm Dwr, near Llandovery. The latter is sometimes called the Thermopylæ of South Wales, and is celebrated alike for its beauty and its historical associations. Perched near the top, is a little Dissenting chapel, built over the dividing line: the pulpit in one age, and the end gallery in another, separated by a gulph of unnumbered centuries! The rock beneath is remarkably full of shells, with, it is said (but I have never found any), occasional examples of Dipterus and Onchus.

Over the tile stones appears the CORNSTONE, consisting of red and green argillaceous and spotted marls, with courses of concretionary, impure limestone, mottled red and green. Splendid sections may be seen at Llanstephan, near Hay, and in the valley of the Usk, near Abergavenny. The Hereford and Newport Railway gives the traveller a passing glimpse of several very fine cuttings. Its characteristic fossils include the well-known Cephalaspis. Its surface is characterised by numerous circular depressions. Let us suppose a walk from Llanfihangel to Llanthony Abbey. On the way, your old guide (mind, he must be old, the young ones are all growing so dreadfully prosaic), will

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point, reverentially, to multitudinous "Kelpie rings" on the surface of the rock. He will tell you, how once on a time, a naughty woman (the chroniclers declare it was Satan in the shape of a woman), wishing to lead St. Anthony astray, on a certain dark night stole a favourite mare and colt of his, expecting he would follow in pursuit. The good Saint, however, was too old a bird to be caught with such chaff. He wisely kept within doors, and simply prayed that the mare, the foal, and the woman (who foolishly wore pattens), might leave clear footprints on the rock, by which his servants might track them in the morning. It was done; and there they are to this day as distinct and fresh as ever!

Meanwhile, *sub rosa*, what says the geologist about them? He has the credit of being able to believe very strange and abnormal things, when they happen to "fall in" with his philosophy; but that is confessedly too much for him. Whatever his opinion of human nature in general, he cannot be persuaded there were ever enough of naughty women in the world to make all such marks with which he is familiar. In the escarpment of the Skyrrid, and all along the precipices of the Daren and the Holy Mountain, and the dependent ranges stretching up through the Black Mountains into Montgomeryshire, he sees these depressions by tens of thousands. Wherever, in fact, a rock of such varied composition as the Cornstone is exposed to atmospheric agencies, the result must be a wearing away of all blotches or concretions, which are softer than the enclosing rock. Some one compares them to pits left on the fair face of Nature, by an attack of smallpox, on a large scale.

Next to the cornstone, comes the GREAT CONGLOMERATE which fills up by far the greater part of our field of vision. It consists in the main of a chocolate brown, coarse-grained sandstone, deposited in a troubled sea; and is beautifully exposed at not a few points along the old coach road from Hereford to Brecon. For its type in this district, let those who have passed through it, recall, and those who have it yet to come, look out, for the splendid sections along the favourite honey-moon excursion down the Wye from Ross to Monmouth. Nowhere else can it be studied to such advantage, excepting perhaps on the many-headed cloud-capped sierras of the glorious old Beacons of Brecon and Carmarthenshire! In the last, we have, according to Murchison, a mass of red rocks not less than 9000 feet thick, though the mountain itself is only 2860 feet above the sea! The Blorenge is another capital study, where the old red plunges suddenly under the carboniferous limestone.

I fear there is no spot of any very special interest in the Conglomerate within reach this morning. The nearest must be five or six miles off, N.E. by E., within a few hundred feet of Maesyberllan chapel. It is an old copper mine, described at some length by Sir Roderick Murchison. The vein stuff thrown out from the trial shafts (the works having been long ago abandoned) contains much crystalised carbonate of lime, chiefly of the primary rhomb, with sulphurets of copper and iron, partially diffused through a mass, the remainder of which is made up of scales of green earth and crystalised blende, known by miners under the euphonious name of "Black Jack." The rock sections in the neighbourhood are nothing particular to boast of, but the scenery around will amply repay a good long walk. A little beyond is the celebrated Brecon Anticlinal. He who could go so near that, and yet be able to resist the temptation of a visit, would, in verity, be a Goth of the first water! I would not, for a trifle, "put him on my list of friends!" But before leaving this part of my subject there are two remarks I should like to make, which perhaps the company will be good enough to carry with them in their rambles for the next hour. They relate to the chemistry of the system, and furnish a key to the explanation of not a few of its most common superficial phenomena.

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Everybody at all acquainted with the Old Red Sandstone must often have been struck with its prodigious number of nodules, containing in nine cases out of ten a nucleus of organic matter, with spherules of black or colourless blotches. In accounting for them Sir C. Lyell gives the following beautiful story :—"An earthern pitcher containing sulphate of iron had been suffered to remain undisturbed for twelve months. Some luckless mice had meanwhile fallen into it and been drowned. When it came to be examined, an oily scum and a yellow sulphurous powder, mixed with hairs, were seen floating on the top, and the bones of the mice discovered at the bottom Over the decaying bodies the mineral components of the fluid had been separated and precipitated in a dark-coloured sediment, consisting of grains of pyrites and sulphur of copperas in its green and crystalline form, and of black oxide of iron. The animal and mineral matters had acted on each other, and the metallic sulphate, deprived of its oxygen in the process, had cast down its ingredients." In like manner, we are told, the putrifying bodies of the fish of the Old Red were covered with a deposit of lime, with which the water was charged, and hence the nodules enclosing them. The form of the nodule almost invariably agrees with that of the ichthyolite within. It is a coffin in the ancient Egyptian style. Was the ichthyolite twisted half round in the contorted attitude of violent death? the nodule had also its twist. Did it retain its natural posture? the nodule presents the corresponding spindle form. Was it broken up and the outline destroyed? the nodule is flattened and shapeless. In almost every instance the form of the organism seems to have regulated that of the stone.

The next fact to be noticed is still more important in this immediate neighbourhood. I shall give it in the words of Hugh Miller. "A very different chemical effect of organic matter may be seen in the darker coloured arenaceous deposits of the formation, and occasionally in its stratified clays. In a print-work, the whole web is frequently thrown into the vat and dyed of one colour; but there afterwards comes a discharging process. Some chemical mixture is dropped on the fabric; the dye disappears wherever the mixture touches, and in leaves, in sprigs, and patches the cloth assumes its original white. Now, the coloured deposits of the Old Red have in like manner been subjected to a discharging process. The dye has disappeared in oblong or circular patches of various sizes, from one-eighth of an inch to a foot in diameter; the original white has taken its place; and so thickly are these speckles grouped in some of the darker tinted beds, that the surfaces, where washed by the sea, present the appearance of sheets of calico. The discharging agent was organic matter. The uncoloured patches are no mere surface films, for when cut at right angles their depth is found to correspond with their breadth. It is well for the young geologist carefully to mark such appearances, to trace them through the various instances in which the organism may be recognised and identified, to those in which its least vestiges have disappeared. They are the hatchments of the geological world, and indicate that life once existed when all other legible record of it has long since perished." All over this district these are specially abundant, as shown by almost every stone wall in Breconshire. Perhaps one half the pebbles you look at are colourless in the middle.

Besides, however, the great mass on which we now stand, there are very important outliers, like islets of Old Red in an ocean of gray, especially interesting to geologists. See, for example, the Forest of Clun, near Newtown, covering about ten miles square, composed of the lower group of the old red, and having the Silurian underneath. See another, about five square miles, between Presteign and Knighton, and a third, still smaller, on the S.W. of Presteign, called Nash Scar Ridge. It is sufficient to state that these have been separated from the main by elevatory forces, which pushed in igneous rocks and caused great denudation in the overlying deposits. Wherever they

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occur, the agricultural surface presents a marked contrast to that of the surrounding Silurian, being, in fact, repetitions on a small scale of the large basin of the Devonian

Let me now speak of its fossils. As a whole, the system was by no means fertile in plants, or at any rate their remains are few and confined to limited areas. Among the tiles and the laminated shales of the upper division we have impressions of sea weeds, of marsh plants apparently allied to the bulrush and sedge, and of land plants allied to the tree fern. These generally occur in a fragmentary and carbonised state, as if they had been drifted from a distance to the sea of deposit. In the Fife and Forfar flagstones there is also an abundance of so-called "black-berries" and "raspberries," supposed by some to be the spawn of mollusca, and by others the fruit of some unknown plant. Of its zoophites, nearly forty species have been found in this country, and thirteen species of echinoderms, the names of which it would be dangerous to the teeth to pronounce. With them have been found many crinoids, generally distinct from those of the carboniferous lime. Its mollusca present a still more formidable list, amounting to about 300 species. Its crustacea are specially important. In fact, the tile stones constitute a great zone of crustacean life, altogether distinct and peculiar, and which is only beginning to reveal its treasures to palæontologists. Notice particularly the Brontes flabellifer, a characteristic trilobite, and the gigantic Pterygotus, called by quarrymen "seraphim," remotely allied to our modern king crab.

Still more wonderful and much more important are its fishes. The whole system is called by way of eminence the Thaumichthyferous, that is, in plain English, the wonderful fish period. And truly wonderful they were, unlike anything the world ever saw before or since. An extract from H. Miller will make this plain:—"Half my closet walls," says he, "are covered with the peculiar fossils of the old red, and certainly a stranger assemblage of forms have rarely been grouped together; creatures whose very type is lost, fantastic and uncouth, and which puzzled the naturalist to assign them even their class; boat-like animals furnished with oars and rudder; fish plated over like the tortoise, above and below, with a strong armour of bone, and furnished with but one solitary rudder-like fin; other fish, less equivocal in form, but with the membranes of the fins thickly covered with scales; creatures bristling over with thorns, others glistening in an enamelled coat, as if beautifully japanned—all testifying of a remote antiquity, a period 'whose fashions have passed away.' The figures on a China vase or an Egyptian obelisk are scarcely more unlike what now exists in nature." Any attempt to describe these would require a volume; they must, therefore, be "left alone in their glory" for the present. That is the less to be regretted, as you are not likely to meet with any specimens to-day. No doubt there are points, quite within view from Mynydd Troed, where you might expect to find a variety of shells, and perhaps a few worm-tracks in the tiles, scales, &c., of fish, as the Cephalaspis, &c., in the cornstone, and an abundance of instructive nodules in the conglomerate. In the main, however, the rocks about Talgarth were too stormy in their origin, and too deficient in lime, to be likely to afford the fossilist any satisfactory harvest.

Have I wearied you beyond all endurance? If not, pray lend me your attention for two or three minutes more. Turn your eyes directly S.E. and look carefully at that stalwart, ragged interloper called Pen-cerrig-calch, which the club visited last year. Speaking of this, Sir R. Murchison says—"I found the culminating point of this arid and lofty mountain 2200 feet above the sea, presenting the limestone not less than fifty feet thick, and occupying an isolated yet distinct escarpment, covered by the true millstone near 200 feet thick. The chief mass is thick bedded, compact, crystalline, and cream-coloured, without fossils; but on some of the thinner beds on its southern face, where they disappear beneath the millstones they become oolitic, and contain a

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few organic remains. In this, therefore, we have a palpable demonstration of violent dislocation. After the deposit of the millstone grit, however recent that may be, as compared with the Devonian, in whatever way the carboniferous deposits may have accumulated, their present basin was produced by subsequent upheavals and dislocations. The removal of the enormous masses of grit and limestone, which formerly connected this outlier with the coalfield, and the formation of the present valley of the Usk—here five miles wide and nearly 2,600 feet deep—must be ascribed to such dislocations, combined with the action of powerful currents. This, therefore, is manifestly a "valley of denudation," and the detritus of the excavating process is seen piled up in vast mounds and terraces of gravel near Abergavenny, and for miles on both sides of the river. Standing there, with Murchison in your hand, you could at once mentally realise the process. Let us imagine it, somewhere about the chalk age, possibly at the time of the great volcanic outburst which threw up the Giant's Causeway in Ireland, and the Isle of Staffa, &c.,—a hot, sultry, heavy, and murky-looking day, with an awful stillness in the air,—when suddenly a long-drawn, sepulchral howl or crash, is heard at a distance, and a tremor and strange quivering and surging are felt in the earth, followed by a fearful wrench—a rending and toppling of mountains in chaotic confusion —while beyond, the sea bottom madly leaps to the surface, driving the waters with a roar to which that of Niagara is but a whisper, in a body several hundred feet deep, far up into the gorges of Brecon and Radnorshire, and sweeping away in the recoil many millions of tons of old red sandstone and mountain lime. Some such process as this made the Welsh coal-fields accessible. And all for what purpose? Merely that in the 19th century of the Christian era, "Molly might put the kettle on" for tea, or Johnny have a fire to warm his toes in winter, or the Naturalist Field Club to travel in spring by express. Doubtless, it was done for Molly, and Johnny, and the Naturalist,—not, however, as mere short-lived animals requiring food, or warmth, or even scientific knowledge,—but as immortals placed here at school, in preparation for an incomparably larger, nobler, truer, and more enduring existence. The issue will yet prove it was well.

Of the patches of modern Alluvium in the valleys of the Usk and the Wye,—around the lake of Llangorse—and in the flat near Talgarth, I need not speak. "He who runs may read them," without any trouble. At certain points in them, however, especially between Talgarth and Brecon, along the old tramway, there are occasional drifts of sea sand, which are well worth studying, though I am not prepared satisfactorily to explain them. Note should be taken by compass of the exact direction of the dip, and talus (or least abrupt side) of every hill you climb. Gravel heaps always tell the story of their birth pretty plainly, if you will only mark carefully their relative position and material. The boulders, many obviously of Scandinavian origin, strewed over the surface, are in themselves a library, on the much controverted subject of drifts. In the Black Mountains—he must be strangely blind who cannot find a thousand indisputable examples of glacial action!—if my memory is not singularly treacherous, the "mind's eye" may see glaciers as clearly on the eastern side of Cwm Du (near Crickhowell) as at Chamounix itself! That perhaps is a bold saying, but it is nevertheless perfectly true. History falls not just now within my province, otherwise Mynydd Troed would be a tempting pulpit from which to preach sermons, on or about the old encampment on the Crûg, near Brecon, the mediæval monkish college not far from Crûg Cadarn; Prince Llewelyn, Lord Cobham, Cwm Pwca, where Shakspere is said to have written his "Midsummer Night's Dream;" Walter Cradock, John Penry and Howell Harris, Lady Huntingdon, Lord Oxford, the Marquis of Worcester's "Century of Inventions," &c., &c. "*Cum multis aliis*, whose name is legion." The somewhat scampish, mock-heroic Twm Sion Katty may be added in quality of a tail-piece! Assuredly the

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picture need not be dull for want of life figures. By the way, Mrs. Siddons's advent at the Brecon "Leg of Mutton," should not be forgotten, nor yet perhaps Sir Hugh Evans, at the Priory Church, or Sir David Gam, at the adjoining manor house. Cromwell preaching at Maesyronen (the field of the ash trees) is another vision worth recalling.

The President concluded by pointing out the road to be taken to Llangorse Common, and announcing that as the trains left Talgarth very early, and there were many visitors, the business of the club must be transacted before dinner.

When the paper was finished, Mr. E. Lees, of Worcester, made a remark in reference to the legend of the circular marks said to have been supernaturally impressed on the sandstone. This was in fact a repetition of the old Herefordshire legend of St. Catharine, the tracks of whose mare and colt were so well known in the old red sandstone between Clifton-on-Teme and Ledbury. Some legend invariably accompanied these hollows in sandstone wherever they appeared, and it was very curious that in former times such notice should have been taken of natural objects, when if noticed by rustics for the first time in the present day no pains would be taken to make a tale out of them, or give any saint the credit of contributing to their formation.

On the summit of the hill the whortelberry, *vaccinium myrtillus*, was found blossoming freely, and from a hole in the rock Mr. Martin got a few specimens of the brittle fern, the *Cystopteris fragilis*. In a meadow on the descent of the hill the same gentleman discovered that rare fern, the moonwort, the *Botrychium lunaria*. The *Lycopodium alpinum*—the alpine club moss—was also gathered on thehill. The herb Paris—*Paris quadrifolia*, the bird cherry—*Prunus Padus*, and the globe flower—*Trollius Europæus*, were also observed to be growing freely in several localities.

Pointing to the lake in view, though with a considerable breadth of country to get over in steeple-chase fashion, the President then gave the word to advance, and a somewhat irregular scutter took place down hill, the slippery turf rendering the descent more treacherous to the feet than even the arduous ascent, and when the cultivated country was gained there were many stiff fences to surmount, in the course of leaping or struggling through which some of the party came to grief. The botanical section, however, were solaced with the view of several meadows refulgent with the globe-flower *(Trollius Europæus)*, the pretty pink-coloured *Pedicularis sylvatica* was plentiful, while in one pasture numerous specimens of the moonwort *(Botrychium lunaria)* was gathered. The crest of the Mynydd itself had only produced *Lycopodium alpinum*, and the delicate little fern *Cystopteris fragilis*. In various copses and hedges, one of the most beautiful objects seen during the day was the bird-cherry *(Prunus Padus)*, which scattered over the whole country between Talgarth and Llangorse exhibited its pendulous racemes of silvery flowers most profusely. But little could be done with the hammer, and fossils were therefore scarce, but in one part of the descent a quarry of cornstone recently broken into was observed, and here the Rev. G. H. Cornwall detected portions of the *Pteraspis* and *Cephalaspis*.

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On Llangorse Common the broken columns of the adventurous naturalists were re-formed, and no losses were reported except that of a rather unweildy and worn vasculum which unfortunately received a compound fracture from the wheel of a carriage going over it, and to the grief of its owner was left *hors-de-combat*. The mysterious lake of Llynsafeddon, whose waters, according to the legend, overwhelmed the old city of Loventium in days of old, now tempted the naturalists to look out for those sunken towers that Giraldus Cambrensis has mentioned; and one gentleman, we understand, had determined to find a crannoge, such as the Swiss and Irish lakes furnish, if possible. Several Charons, with boats, that had rather a flimsy appearance, presented themselves, but these when loaded and in "the trough of the sea" proved rather too suggestive for timorous landsmen, and the wind really raising the disquieted lake into waves, it was not deemed advisable to risk a lodgment in the ruined towers below, and this part of the programme was rather quickly rowed over; but the zealous antiquary alluded to declared to have seen "a pile" himself—though whether it can be assigned to the crannoge era is more than we are inclined to assert. The separation of the party in boats, however, occasioned one little misadventure, which may adorn, or at least vary our tale. A band of devoted mediævalists chartered a boat across the lake to the church of Llangasty Tal-y-llyn, which as a prettily adorned structure, "all beauteous within," has attained some celebrity, and has numerous "octaves" and services almost daily of a high ritualistic character. Here lingering beyond the time noted on the card, seduced by the "dim religious light" that invested them in the storied aisle, the coaches, by some error or misunderstanding, went on from Llangorse, and the mediævalists found too late that modern improvements in travelling were denied them, and they had to foot it all the way to Talgarth, arriving when the feast had been brought almost to a close, though, fortunately, some pike had been reserved for them.

No other incidents of flood or field intervened between Llangorse and Talgarth, and the large room at the Ashburnham Arms was well furnished with guests to a substantial dinner soon after four o'clock p.m.

The President and leading members of the club did not go upon the lake, but left at once for Talgarth to transact business before dinner, leaving the rest to follow. R. M. Lingwood, Esq., the late honorary secretary to the club, and Flavell Edmunds, Esq., were unanimously elected honorary members of the club. This and the other business matters had scarcely been concluded, when the carriages with the members and visitors began to arrive, and wander over the hotel in all directions. At the dinner summons, however, they soon assembled again in the large room, which they were not a little surprised to find decorated with flowers, and flags, and evergreens and mottos, English and Welsh, in great abundance. A fine painting of the harp ornamented the top of the room, whilst the characteristic leek hung on the walls at the bottom. The Gwendolin festival had been held there the day before, and the ladies had most kindly left their decorations for us. It was soon seen that

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there was something wrong at the head of the table. Vacant places were there, and names began to be called out without eliciting an answer. At length the Chairman asked if any gentleman was present who went on the lake in the first small green boat. Still no response. It was now plainly manifest that five gentlemen had been left behind—and the last seen of them was, as they left the green boat to visit the beautiful church at Llangasty Tal-y-llyn on the other side of the water. The regret was universal, but nothing could be done, for the carriages came from Brecon and Hay, and had all been dismissed. In about half an hour, however, a pleasant rumour ran through the room that they had arrived, and the honorary secretary immediately left the table to welcome them. Space was made for them at the top of the room, and as they appeared, to their great surprise they were received with such unanimous clapping of hands that their fatigue was soon forgotten, and—now that the four mile walk was over—they must have felt themselves in great measure repaid by this cheerful reception.

Leaving them to make up for lost time, the PRESIDENT immediately rose and said, that although it was against the custom of the club to propose toasts, her Majesty's birthday must not remain unnoticed. He gave her Majesty's health, and leaving them to express their loyalty with all the zeal they pleased—for time did not allow him to pause—he had next the pleasant duty to perform of thanking in the name of the club, Capt. Williams, of Talgarth, for the great trouble he had taken, and the information he had obtained for the club, without which they would not have been able to make the arrangements for the meeting which had been so successfully carried out to-day (applause). If the members had been gratified by the exact programme for the meeting which was given on the card, it was to Capt. Williams that it was due—if we were all so pleased and surprised to find this room so prettily ornamented to receive us, with a "Welcome" in capitals, it was due to Capt. Williams's sister—and presently the club would again, he was sure, be gratified by a legend from Miss JANE WILLIAMS, another sister, the celebrated authoress, which he would read to them. In short the influence of the Williams's surrounded the club, and clearly that is all that is requisite to ensure a brilliant reception at Talgarth (applause). The club had that day unanimously elected Capt. Williams a member, and he was sure they would wish also to give him a vote of thanks from the meeting (applause).

He had next to propose a vote of thanks to the Rev. Henry Griffiths for the very able address on the "Geology of the District," which he had had the pleasure to read to them from the summit of the Mynydd Troed. He was quite sure this vote would be unanimous, from the attention with which it was listened to, and from the pleasure it had given to them.

HUMPHREY SALWEY, Esq., of Ludlow, here rose, and, apologising for the interruption, said that he hoped the President would add to the vote of thanks the wish of the meeting that Mr. Griffiths would be so kind as to allow the paper to be printed. He had listened to it with so much pleasure,

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and had gained so much information from the broad clear way in which it was expressed that he trusted that they might all have the advantage and opportunity of reading it also.

T. CURLEY, Esq., of Hereford, and some other members, at once rose to second Mr. Salwey's proposition, and at the evident wish of the meeting the President undertook to communicate with Mr. Griffiths on the subject.

The PRESIDENT then arose, and expressed his regret that the members had been able to see so little of the very beautiful lake they had that day visited. It was full of interest in every point of view; but before he entered upon its especial objects of interest with reference to the club, he wished to bring to their notice a curious legend relating to it, for had time permitted he had intended doing so upon the lake itself. He believed that almost every lake in Wales was supposed to have been the site of a buried city, of which the remains at certain times became visible through its waters. It certainly was so with Llangorse, or more properly perhaps, Llynsafeddan. Sir John Colt Hoare, in his edition of "Giraldus Cambrensis," gives the following old legend, in Monkish Latin, with regard to it—a copy of which had been kindly given to him by the Rev. James Davies, of Moorcourt, that morning. It should be prefixed by the statement that the buried city is said to have been "Loventium," and the lake is called "Brecheinomere":—

Ad Brechnoc est vivarium
Satis abundans piscium
Sæpe coloris varii
Comma gerens pomarii
Structuras ædificii
Sæpe videbis inibi
Sub lacu cum sit gelidus
Mirus auditur sonitus.
Si terræ princeps venerit
Aves cantare jusserit.
Statim depromunt modulos,
Nil concinunt ad cæteros.

This legend has been very happily told by Miss Jane Williams, in her "Celtic Fables, Tales, and Legends," to which he had before alluded, and which he would now read to them:—

A LEGEND OF LLYNSAFEDDAN.

By old Brecheiniog's famous Lake—
That Lake in many a tale renowned,
Three noble chiefs their journey take
Along Cathedin's awful ground.

Full oft those wondrous waters gleam,
A moving field of verdant hue;
And oft with intersections stream,
Of blood like crimson passing through.

And sometimes on the watery plain,
Courts, palaces, and gardens rise;
Graves decorate a gay champaign,
And charm the fisher's wondering eyes.

There when the ice of winter broke,
'Twas with a wild unearthly groan;
As if the horrid jar awoke
A hecatomb's discordant moan.

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For shelter to the tangled reeds
Ten thousand fugitives repair ;
The grebes are diving in the weeds
Herns shriek, and wild swans whistle there.

Returning from King Henry's court,
Prince Gruffydd sought the wide domain,
Which homage, by subjection taught,
Preserved of his extensive reign.

Earl Milo, old Brecheiniog's lord,
And Ewyas' chief of Norman blood,
Friends of the royal heart and board,
Beside the pensive Britain rode ;

And tauntingly Earl Milo smiled,
And spoke, as near the brink they drew ;
And all the surface vast and wild,
Serenely noble, lay in view.

"It is a legend of the Lake,
That when the Lord of Wales shall say—
'Ye birds your herald songs awake !'
These birds his bidding will obey."

"Then be it yours," the Welshman said,
"Who hold dominion o'er the land ;
Lords of the castle and the blade,
To issue forth the high command !"

They paused. Earl Milo's thundering voice,
Which oft had moved the ranks of war,
Now pealed a solitary noise,
Whose echoes rang from shore to shore.

Then Payn-Fitz-John with angry speech
Adjures the magic Lake in vain,
While smiling retinues impeach,
In whispered words the Norman reign.

Prince Gruffydd knew misfortune's place,
Yet scorned the petty sneer of pride ;
Nor chose that his illustrious race
His prosperous foeman should deride.

Dismounting towards the east he kneels,
As champions ere they meet the foe ;
His gesture silently reveals
A heart in supplication low.

At length he rose, with solemn air,
Then crossed his forehead and his breast,
And looking upward thus in prayer,
Aloud his fathers' God addressed :—

"Oh, let thy providence and power
The line of British sovereigns own,
And vocal birds proclaim this hour
The heir of southern Cambria's throne !"

He spoke, the smitten Lake grew bright,
With flash of many a humid wing ;
In solemn notes that breathe delight,
Obedient birds their anthem sing.

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The PRESIDENT then said that he had had the pleasure and advantage of spending the day—yesterday—at the Lake with Mr. Lees, the distinguished botanist, who had done him the honour to come here and attend this meeting of the club. They had taken up their abode at the comfortable fishing quarters of Mr. Henry Pritchard on the common, and he could now bring before their notice some of the spoils they had brought with them. The pike, the perch, and the eels to which they had just done such ample justice, were all caught yesterday or this morning in the Lake, and so they could now testify Llangorse pike were very different from pike in general. They are as firm in flesh as delicate in flavour. He who has not tasted one properly stuffed, roasted, or boiled, as we have to-day, direct from Llangorse, can scarcely know how good pike can be. The next trophies I have to show you are some of the wild fowls' eggs that build in its reedy margin. Here are eggs of the loon, or great crested grebe, the *Podiceps cristatus*, and others of the bald coot, the *Fulica atra*. The grebe egg is remarkable for the porous character of its shell. The lime seems to have scarcely any glazing or enamel on it, and is moreover of very unequal thickness in different parts of the shell. It is so porous that, although perfectly white when first laid, it becomes very quickly discoloured and stained from the absorption of the dark colour of the decayed weeds with which the nest is built. This one which looks so old and dirty is probably quite fresh. The grebes are very numerous upon the Lake, but their nests are exceedingly difficult to find, or to approach when found. The coots are still more abundant, and the eggs more easily obtained. They are of a light brown colour, often with a greenish tint, and numerously spotted over with small dark brown spots. The swans and wild ducks, and plovers and sandpipers breed there, and numerous sea birds are constant visitors and add much to the interest of a row on the lake. It is rather early for water plants, but one of the prettiest objects just now are the red-coloured young growing leaves of the white water lily, the *Nymphæa alba*, as contrasted with the light fresh green of the young leaves of the yellow water lily, the *Nuphar lutæa*. They grow mingled together in great abundance, and when seen in the early morning or evening sun are very beautiful. The President then exhibited a specimen of each plant to the meeting. He next produced a very fine bunch of the marshtrefoil or bog-bean, the *Menyanthes trifoliata*, and pointed out the abundance of the globe-flower, the *Trollius Europœus*, in the fields round Talgarth and Llangorse. This was also shown by the room being decorated with large vases of it, and which quite threw into the shade the few which Mr. Lees and himself had been careful to bring from Llangorse as a rare plant.

The botanical members were very much interested by a small box of orchideous plants, which the President had received that morning by post. W. Leyland Woods, Esq., of Chilgrove, near Chichester, had most kindly forwarded them for exhibition at this meeting. The box contained no less than five specimens of the rare *Orchis muscifera*, or fly orchis, in great freshness and perfection. At first sight it almost seemed as if real flies had

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settled on the green stems of the plants. The box also contained two specimens of the birds-nest orchis, *Neottia nidus avis*, several flower spikes of the tway blade *Listera ovata*, and of the green winged meadow orchis, the *Orchis morio*.

The PRESIDENT then called upon the Hon. Secretary, the Rev. Geo. H. Cornewall, to introduce the subject of "The more remarkable trees of Herefordshire,"—adding at the same time that it was evident his own paper on "Wandering Plants" must wander on still to another meeting.

The Rev. GEORGE H. CORNEWALL then said that he had not brought any written paper on Herefordshire trees. The members had already received a printed notice on the subject, and it seemed to him most desirable that the members should unite their efforts to obtain an exact account of our remarkable trees. It was a very extensive subject, and no one member could hope to carry it out in any reasonable time without the assistance of others. He thought it would be better if different members of the club would take up a different kind of tree, so that the descriptions received might at once be sent to the proper quarters. The President had kindly undertaken the elm and sweet-chesnut, and the Rev. Thomas Woodhouse had chosen the yew tree, the oak had fallen to himself, and he should be very glad if any other of our members would take any of the other trees and let him know. He thought a most interesting record might be thus obtained, and that it was the peculiar province of the Woolhope Club to obtain it.

The PRESIDENT then said that his friend Mr. Edwin Lees, of Worcester, had in the course of his researches collected more particulars as to curious Herefordshire trees than perhaps any other person. As he was present among them, they would be doubtless pleased to hear any remarks he would favour them with.

Mr. LEES then said that, in making preparation for a work on old trees some years since, he had met with several curious veterans in Herefordshire, of which he had taken portraitures. He then exhibited drawings of a yew tree in Cradley churchyard, a most remarkable hollow one in Much Marcle churchyard, and a magnificent ash growing, when the sketch was taken, at Hope End, near Ledbury. Views of some fine oak and other trees were also shown, and remarks made, on trees as objects of scientific study and artistic beauty. Too many landscape painters had made conventional trees in their studios, which might be trees to the artist, but not any one in particular to the naturalist; but it was important that the physiognomy of vegetation should be studied correctly. With regard to the age of the trees, the yew as most enduring deserved particular attention, and many yews now stood alive that had commenced their existence before the Norman conquest. This was doubtless the case with the Cradley yews, and the massive one at Much Marcle. The rings of annual growth were good evidence in the case of the yew when attainable, and he had in his possession the section of a branch of yew, which within a diameter of only nine inches, had 227 rings of annual growth fully discernible. The connection of the yew-tree with the church was

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symbolical, as representing immortality, and not as some had thought for the purpose of making bow-staves for the parish, for curiously enough the bows of the English archers, "dreadful with the bended yew," had been generally made of foreign wood, supposed to be the better material. Hence, in many instances, the original Saxon or Norman church had been built beside a yew tree that stood on a convenient site, and it was not always the yew that was brought to be planted by the church. Oaks, in accordance to an old adage, might very well stand for 900 years, and probably the celebrated Moccas oak was as much as this. Where a yew was hollow, it was not so easy to determine its age, because, as in the case of one of the Cradley yews, fresh layers of alburnum descending from above had surrounded and encased the old decaying hole. Several other noble Herefordshire trees were adverted to, as some grand yews on the Ridgeway, near Eastnor, those in Stanford Bishop churchyard, of very great magnitude, one 27ft. in girth; and the stag's-horn oaks at Colwall, where the Bishops of Hereford once had a hunting-seat.

Mr. Lees was prepared to have extended his observations much further, but as it was announced that the railway train for Hereford was approaching, the proceedings were necessarily brought to an abrupt conclusion. The company now hastily snatched up their *impedimenta*, and hastening to the railway, a very pleasant meeting was most satisfactorily ended by a safe journey homewards.

A LEGEND OF LLYNSAFADDAN.

Under the title of "Cynfig," the same story, with variations, is related in the Iolo MSS.

Where mountain heights surround the vale,
And humbler hills their summits rear
To ornament the spreading dale,
Amid a marish dank and drear,
Calm as the glow of summer skies,
The lake of old Brecheiniog lies.

Tradition tells, in days of yore
(Dates suit not this mysterious tale),
Where the lake spreads its watery store,
A village smiled amid the vale,
And there its lovely Lady dwelt,
To whom an humble Suitor knelt.

A wealthy dower the Maiden owned,
Yet coveting augmented store,
The suitor's poverty she scorned,
And bade him see her face no more:
His melancholy way he went,
On thoughts of love and wealth intent.

When in a solitary place
A travelling Merchant crossed the way,
A man of wealth—with rapid pace
The Suitor fell upon his prey:
Beneath his sword the Merchant dies,
The murderer seizes on the prize:

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Prepares a grave with fearful haste,
And hides his hapless victim there,
Then at the Lady's feet he cast
His treasure, and preferred his prayer.
Surprised, she questions; thrilled with fear
The horrid secret greets her ear.

"Hence, guilty youth," she trembling cries,
"Why should I join my lot to thine?
Vengeance to smite the murderer flies;
Oh, may far other fate be mine!
Receive thy sentence at his tomb,
Nor bid thy loved one share thy doom!"

He went, the moon her radiance veiled
Beneath a cloud of sombrous hue,
The screech-owl's note his ear assailed,
As near the lonely copse he drew,
Sepulchral tones amid the wood,
Asked, "Is there vengeance for this blood?"

"There is," a hollow voice replied,
"A sure, though distant curse shall come,
Nine generations multiplied
The Murderer's race shall share his doom!"
Well pleased, the Murderer hastes away,
Nor fears the long-protracted day.

Nor does the Lady now refuse
To join with his her future lot,
Sin's punishment escaped she views,
The guilt of sin she dreaded not:
Theirs, ere that tardy vengeance fall,
Must be the common lot of all!

They lived their offspring's race to see
With rapid increase spread around,
Survived that hour of destiny
When time the threatened period found,
Yet on the Murderer's hoary head
No storm of wrath its lightning shed.

The festive board, the song of mirth,
Their safety and their joy declare;
Terrific tremblings rend the earth,
Lo, vengeance, ruin, and despair!
And where the Murderer's turrets rose,
The Lake is spread, and Llynfi flows.

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THE REMARKABLE TREES
OF
HEREFORDSHIRE.

THE MISTLETOE-OAK AT TEDSTONE DELAMERE.

MARCH, 1867.

The Mistletoe is known to have existed upon this oak for about 38 years. Dr. Cradock (Principal of Brasennose College) discovered it there in 1851, but the woodman had known of it for more than 20 years before. He kept it a secret, and only produced a small portion on particular occasions. The Mistletoe grows in one bunch of five stems close to the trunk of the tree, at about 40 feet from the ground. The oak *(Q. pedunc.)* is situated in the corner of a wood on Primrose Hill, on the property of E. Bickerton Evans, Esq. As shown here, it is crowded by other trees, and the ivy has nearly reached the Mistletoe. At the request of the President of the Woolhope Club, Mr. Evans at once had the ivy cut from it, and has very kindly promised to remove the trees around it.

(Ladmore, Photographer to the Woolhope Naturalists' Field Club.)

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The Woolhope Naturalists' Field Club.

MEETING AT KINGTON,

JUNE 26TH, 1866.

On Tuesday, the 26th inst., the second field meeting of this club for the present season was held at Kington. The day was a magnificent one, the brightness and heat of the sun being tempered in some degree by a gentle breeze, and there was a large attendance of members from various parts of the district.

The President, (Dr. Bull) and the committee met at the Barton Railway Station in this city at 9 a.m., and held a meeting at which several gentlemen were elected as members of the Club, and others duly proposed.

At 9.50 a large party left Hereford for Eardisley, by the Hereford, Hay and Brecon railway, the clean neat state of the carriages, and the smoothness of the travelling being remarked by some of the visitors from a distance, as giving a satisfactory idea of railway developement in this district. The beauty of the scenery along the line, too, was the theme of general admiration; the wooded Credenhill with its suggestions of Roman and Saxon warfare, and its picturesque church; the peaceful fields dotted with sheep, once covered with the houses of busy Magna Castra; the "leafy honours" of Garnons-hill; the ivy-covered ruins of old Yazor church, and the "heaven directed spire" of its neat successor; the beautiful Lady-lift with its diadem of trees, suggestive of the renowned author, Sir Uvedale Price, who was not only their planter but the cause by his writings of many other beautiful estates being so laid out as to develope their natural capability of being made beautiful; and then, in descending the long incline between Kinnersley and Eardisley stations, the glorious view westward of the richly wooded vale of the Wye, with its noble framework of wooded hills, behind which rise the huge wall of the Hatterill range, the Radnorshire Beacon, the far-off Radnor Forest, and other lofty summits, all successively delighted the visitors, as far as the hazy state of the atmosphere permitted them to be seen. This difficulty, however, did not mar their view on returning, when the exquisite clearness of the atmosphere not only revealed the full beauty of the view, but invested it all with an added charm in the golden glory of the evening light.

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At Eardisley station, where the party left the train for another "train" of vehicles which awaited them, they were joined by the hon. secretary (the Rev. G. Cornewall, of Moccas), and some gentlemen from Hay and other places farther westward; and the whole party proceeded to Kington, on the way, owing to the haziness of the atmosphere already mentioned, seeing but imperfectly the fine view of the Breconshire Beacon and the long range of mountains stretching down far into Carmarthenshire, of which those twin summits are the culminating points.

The party reached the pretty little town of Kington shortly before 11 o'clock, and were there received by R. W. Banks, Esq., Rev. J. F. Crouch, of Pembridge, and other members residing in the Northern part of the Club's district. After a very few minutes' delay, the whole party started on a pedestrian ramble, Mr. Banks kindly acting as guide.

The first place visited was the "Crooked well," as to the etymology of the name of which two interpretations were offered: one, that the word was a corruption of "crochan," from the cup-shaped indentation of the hill in which the copious spring rises; and another and more probable interpretation, that the word "crooked" is merely the British "crûg coed," or woody hill—an appellation which fairly enough describes the present aspect of the lower part of Bradnor hill, as viewed from the spot where the spring rises. This well is referred to in the Rolls of the Manor of English Huntington, temp. Henry V., as "vocatum a croked mill."

From the Crûg-coed well, the party passed by Ivy Chimney to Bradnor quarries, where an outlying bed of Downton Sandstone is worked. The fossils found in these quarries are the following:—*Eurypterus pygmœus*, *E. acuminatus*, *E. linearis*, *E. abbreviatus*; *Pterygotus Banksii*, *P. stylops*, *P. gigis*, *P. problematicus*; *Pteraspis Banksii*, *P. truncatus*. In the Lower Ludlow rock of Brandon wood, *Pterygotus punctatus*, the same as at Leintwardine quarries.

Mr. Banks explained that the fossils were found on the tile-stone beds, which, singularly enough are found to thin out as the quarrymen advance into the rock. Consequently the fossils had become scarce of late.

The most recent discovery must be noted by the way, which is that in the Downton beds on Huntington hill, in Colva parish, Radnorshire, a short distance to the S. of Kington, a slab of stone with tracks upon its surface has been found; and that Mr. Salter, the eminent geologist, proposes to show in an early number of the *Geological Magazine* that these tracks are those of the Pteraspides, which are peculiar to the Downton beds.

From Bradnor quarries, the party passed by Wallstich farm to Bradnor wood. Near Wallstich are the remains of some fruitless workings for lead, which afford a curious illustration of the errors that "practical" miners, ignorant of Geology, often fall into. Misled by the appearance of a whitish loam a little below the turf, a person who had made a few trials on the Black Mountains was induced about two years since to sink a well here in the hope

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of again finding some fathoms deep in the rock the same white loam, which he regarded as a sure indication of the presence of lead. As the rock at this spot is the Upper Ludlow, it seems scarcely necessary to add that the search for lead was a failure. Not that this speculative miner thinks so. He believes fully that the lead is there, and would have gone on boring to this day probably, if the "supplies" had not very wisely been withheld.

After visiting several quarries, the members made their way to Downfield, the seat of Mrs. Miles, which they had been kindly invited to visit. In the beautiful grounds of this residence they saw and admired a number of noble specimens of *Araucaria*, *Cryptomeria*, and other exotic trees, which flourish at Downfield to a degree almost unprecedented in a very wide district. One fine luxuriant Araucaria was about 30 feet high, and on very few of them could be discovered any brown stems or leaves, those marks of the severe frost of 1861, which destroyed so many of these trees throughout England, and sadly disfigured almost all of them. They examined, too, a fine witch-elm *(Ulmus montana)*, which measures 20 feet in circumference at about 3 feet from the ground. After spending some time in admiring the very beautiful view from the terrace in front of the mansion, the party entered the house, and were hospitably received by Mrs. Miles and her daughter. After partaking of a lunch kindly set out for them, the members took leave of their considerate entertainer, and proceeded to the summit of Stanner Hill, upon which the scientific business of the day was to be transacted.

The Rev. Thos. Hutchinson very kindly brought his Vasculum, well supplied with specimens of the "Lesser Winter Green" *(Pyrola minor)*, gathered near Leominster, and which he freely distributed at this time.

In the ascent of the hill, the botanical members of the party were delighted with the spectacle, in many parts magnificent for the richness of the colours, presented by the wild flowers. The golden yellow of two species of Sedum *(S. Fosterianum* and *S. reflexum)*, the purplish crimson of the *Geranium sanguineum*, and the paler hue of the *Lychnis viscaria*—all being somewhat rare plants—seemed to clothe the rugged hill with beauty. The scene, as viewed from the peak around, and upon which the members seated themselves to hear Mr. Curley's paper on the geology of the district, was striking for its wild grandeur,

"Hills beyond hills in wild succession rising,"

While the deep valleys were rich with waving woods, and here a mansion and there a farm-house looked out over green corn-field or smooth lawn; but was also especially interesting to the geologist from the evidence it affords of geological history. In the beautiful view from that hill the loftier hill called Herrock ("Hercope" of Domesday Book, probably from *Hir*, long, and *cop*, a hill), along the summit of which runs Offa's Dyke, distinguishable from Stanner as a line of brighter green, is a conspicuous feature. The adjoining parish of Knill (the "Chenille" of Domesday) is chiefly remarkable for the

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lofty hill known as Knill Garroway (probably from *garw*, rough). The two quaintly named places, Burlinjobb and Evanjobb—manifest corruptions from Burchelin's cop and Evan's cop (and commonly called "Burchop" and "Enjob")—also form constituents of the view. At the former village the Woolhope limestone appears on the side of the Old Radnor hill, being tilted up by the outburst of trap.

The conflicts of igneous action, fierce beyond anything dreamt of by Ovid, when he sang of the strife of hot and cold, and dry and moist, when all things were unstable and mixed, here write themselves out at large,

"Plain for all folk to see,"

Who have eyes to see withal; and the course of the fiery tumult of elements is worth tracing, as may be done easily with the help of the able essay read on the spot, which we append.

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GEOLOGICAL FIELD ADDRESS,

By T. CURLEY, Esq., C.E.

STANNER HILL, JUNE 26, 1866.

The Woolhope Club possesses one of the most interesting districts in the British Isles for the study of Geology. Taking Hereford as the head quarters of our club, and describing a circle of 40 miles around it, we have within that radius the whole of the upper and lower Palæozoic rocks, and the whole of the Mesozoic rocks, with the exception of the Cretaceous; and what is more, on the Malvern hills we have an example of the Laurentian formation so largely developed in Canada. The Cambrian system within our circle can be examined at Church Stretton; the Llandeilo formation at Llandegly and Llandrindod, the Llandevery at Mayhill and Woolhope, the Wenlock and Upper Ludlow at Woolhope, Ludlow, and all around Stanner, where we now stand; the Old Red or Devonian all over Herefordshire; the Carboniferous at Pontypool, Forest of Dean, and Clee Hill; and the Permian to the north of Bewdley.

The following formations belonging to the Mesozoic series may be found within the same circle, viz., the Trias at Worcester, the Lias along the banks of the Severn, between Berkeley and Gloucester, and at Maindee, and the Oolitic at Stroud.

The igneous rocks within this district are very remarkable, and I shall presently refer to them. Hereford must certainly be considered the most central and convenient head-quarters for the geological student, for there is no other city in Great Britain that, within a circle of 40 miles, will embrace so many geological formations without any break in the order.

The great valley of the Wye, in the centre of which the city of Hereford is itself placed, affords, too, a most promising opportunity to the physical geologist for the study of Drifts and Gravel beds. We have there three distinct terraces of gravel, proving as many distinct levels at which the Wye has stood in former remote periods. These beds require careful investigation. Sir Charles Lyell, my friend the Rev. W. Symonds, and many other of our best practical geologists are now studying them closely in other places. We must follow their example, and as they are worked, carefully watch for any remains of organic life that may become exposed. In one of these terraces, in a gravel bed near the Infirmary, the tooth of an elephant was found a few years since, and two years ago I myself had the good fortune to find in an ancient gravel bed of the Lugg near Dinmore the tooth of the *Rhinoceros tichorinus*, which I now exhibit to you, and which is the only relic of that extinct pachyderm yet found in the county. The beds are not rich in organic remains, but at any time they may possibly be discovered, and probably have often been lost to science for want of an observer.

The valley of elevation of Woolhope, from which our club takes its name, presents a most interesting field of geological phenomena. There is no other example within so short a space that gives the geologist better data for computing the amount of denudation which has taken place since the upheaval of the Silurian rocks through the Old Red Sandstone. The central dome of Llandevery rock is there flanked all around by highly tilted formations of Wenlock Limestones, and Shales, and Upper and Lower Ludlow formations, which were once continuous over, and concentrical with, the dome of the Llandovery rock. It may be calculated that something like 3,000 feet of Silurian rocks have been removed by denudation, without taking into account the immense mass of

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Old Red which must originally have overlaid the Silurian Rocks. Imagine a slice cut from the top of an onion. If you wish to compute the thickness of the part cut off, you may very readily do so by means of the thickness of the coats remaining, and this will give you a clear idea of the data that the Woolhope Valley affords for computing the amount of its denudation.

The Malvern range affords an excellent example of volcanic action. The force which probably threw up the Silurian rocks through the Old Red Sandstone at Usk and Woolhope found a vent at Malvern, and poured forth in a fluid state the rocks which form so beautiful an outline in the scenery of this county and Worcestershire.

The Clee hill Coalfield is again a most interesting subject of study. It is perhaps the highest in England above the sea level, and there is reason to suppose that it was absolutely lifted upwards by volcanic action. Dislocations having occurred from this violent action, the molten Basalt has passed upwards through the crevices thus formed, and has overspread the entire coal formation.

There is also an exceedingly interesting coalfield at Leebotwood, near Church Stretton. It is, I believe, the only example where the coal formation rests, immediately, on the Cambrian rocks. This fact has been overlooked by Sir R. Murchison in his "Siluria."

To come now to the geology of this immediate district. Let me draw your attention to the remarkable eruption of the Stanner rocks, on which we now stand, and which form so prominent an object in the landscape. This rock is charged with Hypersthene, and is the only rock in the British isles, with the exception of one at Skye, which contains this mineral in any appreciable quantity. Ordinary typical granite is composed of quartz, mica, and felspar. The Syenitic granite of Hunter-hill, which you see before you, and also of that of the Malvern range, is composed of quartz, felspar, and hornblende, whereas the hypersthene granite of Stanner is composed of quartz, mica, and hypersthene. Hypersthene is a member of the hornblende family, and is so called from its power of resisting acids, as compared with augite, to which it is closely related. It has a vitreo-resinous lustre and a brown or greyish green colour, passing into black. Hypersthene is a ferrosilicate of magnesia, with only traces of alumina and lime, and in this it differs also from augite, which contains as much as about 20 per cent. of lime.

Many persons think that the age of geological discovery has passed away; yet in this very district, at a Woolhope club meeting held on the 29th July, 1856, the carapace, swimming feet, pincers, and some other portions of a gigantic lobster, some six or seven feet long, were discovered in the quarry of Downton sandstone on Bradnor-hill, which you have had the advantage this morning of visiting under the guidance of Mr. Banks. This distinguished member of our club had previously discovered, and worked out with much care and perseverance, several parts of an allied crustacean, and on the day to which I allude Mr. Salter, who was present at the meeting, drew the animal full size from the portions obtained, restoring by outline the missing parts. Mr. Salter, in honour of the discoverer, gave to this huge lobster the name of the *Pterygotus Banksii* (hear). Whether the temperature of the sea in which the creature lived may have been greater than which at present prevails around the British isles, I will leave to the speculative and inductive geologists of the meeting.

We found on this same day a specimen of the Pteraspis, which Mr. Banks was also so fortunate as to discover, and which also bears his name. It is not necessary to allude further to the fossils of the district, for Mr. Banks himself, in his address as president of our club, has given us the very valuable list which is published in the transactions.

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The Downton Sandstone has been generally included in the Silurian rock, and on the ordinance geological maps it is so coloured; but it is to be hoped that on the next revision of the maps these distinctive beds will be shown by a colour of their own.

The Downton Sandstone is lithologically a true transition formation, and cannot be classed as a whole with the Silurian or Old Red Sandstone. It is not composed of the denudation of the adjacent Ludlow rocks, but is probably formed from the destruction or disentegration of the Caradoc Sandstone, which it greatly resembles.

These passage beds are here, according to Murchison, only 40 to 50 feet in thickness. Mr. Banks has again rendered good service to geology by detecting in them a series of fossils which prove beyond all doubt, that fossils in themselves are not so distinctively characteristic of particular formations as they were before supposed to be. I believe the Downton Sandstone contains the oldest recognisable vegetation yet found in England and Wales; but it does not at all follow from this negative evidence that there was not a rich flora at the time of its deposition, for in the old Silurian rocks in Scotland traces of land plants have been discovered.

The Downton Sandstone is well developed in the band at Ludlow. In the published geological section running across that town, it is represented from my own actual observations to be 80 feet in thickness. Few organic remains occur there, the principal ones being the fishes *Pteraspis* and *Cephalaspis*, with the crustaceans *Eurypterus*, *Pterygotus*, and the small *Beyricha*.

On examining the district immediately around Old Radnor you will find that there is a line of *Fault* running from the West side of Stanner hill, in a north-easterly direction, to Nash Scar. On the east side of this line of Fault the Wenlock Limestone and Upper Llandovery rock are thrown up. On the western side of the Fault appears the Old Red Sandstone of Radnor wood. This Fault was caused by the force which caused the protrusion of the Stanner rocks, and the upheaval of the Wenlock Limestone of Nash Scar.

There is also another *Fault* running past the east side of Old Radnor hill, nearly parallel with the Fault already alluded to, and about half a mile from it. This line of Fault was caused when the Syenitic granite of Hunter hill was thrown up, and the Wenlock Limestone and Llandovery rock of Old Radnor appeared.

The flat district north-west of Old Radnor and around Harpton Court is on the Wenlock Shale, where it is very much obscured with a deep covering of gravel. Radnor Forest belongs to the Upper Ludlow formation, and the country south-east of Llandegley is on the Llandilo Flags and Shales.

The amorphous, massive, and crystalline condition of the Wenlock Limestone at Nash Scar and Old Radnor was caused by the action of heat issuing along a line of fissure, which, emitting the igneous rocks of Stanner and Hunter-hill, fused the strata into huge amorphous masses, and left films of Serpentine on the faces and joints of the altered limestone.

On the western slope of Old Radnor hill in the Wenlock Limestone casts of the *Pentamerus oblongus* and other fossils may be found.

Looking to the north-west of Old Radnor, all the land visible was above the level of the sea when Herefordshire and the other parts of England eastwards were below it. Possibly at that time Wales, with the Isle of Man and Ireland, may have formed a series of islands in the ocean.

From the distribution of land and water, and from astronomical causes, there is no doubt but that the climate of this district was much more severe at one time than at present, for we have abundant evidence of glacial action in many places. I may

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instance, the large boulders of Conglomerate strewed over Llandrindod Common as examples beyond doubt of masses of rock transported by ice, for there are no rocks of a similar character within many miles of the place. There is one boulder lying near the road below the Pump-house, which I measured. It now weighs about 100 tons, and was much larger before they broke off large portions to mend the roads.

In conversation with one of the natives a few years ago, I found that the theory he entertained of this transported boulder was that the Devil in passing along had got this pebble in his shoe, and as it hurt his foot, he cast it on the common. I gave the old man great offence by suggesting the ice theory to him.

Among the facts put in evidence by geologists regarding the former conditions of land and sea, none are more convincing of change and systematic diversity than the remains of plants and animals. By this testimony it appears that over every part of the earth's surface, in every class of organic life, the whole series of created forms has undergone great changes. The prevailing opinion is that variations of the forms of existing animals and plants must be exceedingly slow, since no material change has taken place in our cultivated grains or amongst our domestic animals for many hundreds of years of human experience. It follows, as a necessary consequence, that no considerable changes, such as the total extinction of old forms of life and the introduction of new forms, arising from such causes as are now in action, could take place without allowing very long periods of time. Estimated in this way, and considering the great number of living creatures that have lived through their periods and actually become extinct, the antiquity of the palæozoic rocks which surround you is inconceivable. Nevertheless, during all that inconceivable period, we have no reason to suppose but that the same forces were seated in the same particles of matter; that the same influences resided on the surface of the earth; that the same laws governed the movements of the planets in their ever-changing paths around the sun.

Geological phenomena of every order can be expressed in terms of magnitude, such as the uplifting of mountains, the deposition of strata, and the numerical changes of the forms of life.

The time required to produce these effects could also be calculated if we did but know the rate at which they were produced: but if we only know the limits within which it must have operated, the result of any such attempted calculation must have a corresponding uncertainty; and, if we are positively without any knowledge of this rate, all exact calculations are utterly out of the question.

Astronomers tell us that the varying eccentricity of the earth's orbit produces corresponding changes in its temperature. By this cause the total quantity of heat received by the earth within a year is increased or lessened; and the mode in which this heat is distributed on the circumpolar spaces is still more largely affected. At one epoch the summer and winter temperature are made more equal; at another they are made more widely different. Now, if at one of these epochs of maximum eccentricity, the earth was in aphelion at the time of our winter, much heavier falls of snow might take place and continue for ages, and glaciers might be largely increased both in number and extent. Under contrary circumstances, less snow might fall, its duration might be shorter, and its attendant glaciers might become smaller and less permanent. To this latter condition the present state of the Arctic Regions corresponds, and by consulting the astronomical tables, Professor Phillips maintains that a condition of extreme glaciation, dependent on the maximum eccentricity of the earth's [illegible], cannot have happened within the last 100,000 years.

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The opinion, however, has long been growing among geologists that it is rather by a rising and falling of the surface of the land, and consequent alteration in the sea level, that the great variations in temperature must be explained. Such changes are admitted to have taken place in the mountain regions of the Polar circles. In Switzerland also there is distinct evidence of two great extensions of ice having taken place in former times, the latter one corresponding possibly to the age of our own glacial drift.

Gentlemen,—The Rev. W. S. Symonds, who was to have given us the geological address to-day, has been called suddenly to Belgium to examine some fossilized human bones found in a cave there. Let us hope that his enthusiasm in the matter of drifts and gravel beds will not lead him unconsciously within reach of any German military earthworks. He has promised to attend our Builth meeting, when he will no doubt kindly give our club the benefit of his researches if he should happily bring his own "Old Bones" safely away. Meanwhile it was only at the particular request of our worthy President that I considered it my duty as a member of our club to answer to his call, and boldly to venture on the task of supplying Mr. Symonds's place—a post which I cannot but feel would have been much better filled by many of the gentlemen I see around me.

After the conclusion of the paper, which was received with applause, the party proceeded to descend the hill, separating on the way into two groups. One of these took the longer round by the Hanter hill and through the pass between that hill and Worsal wood back by Rhiwbach farm, and thence under Hergest ridge and Held wood to Kington; while the others chose the shorter but more difficult route down the steep side of the mountain, and through the tangled brambles, huge rocks, precipices, and debris-covered slopes, here and there gemmed with flowers of the "Devil's Garden." The characteristic plants of Stanner hill abounding in this part of the "rocks," many a vasculum was enriched on the way down. Among the plants obtained by one or other of the many botanists present were the following:—*Veronica spicata* (spikeflowered speedwell), *Erodium cicutarium* (hemlock storks-bill), *Lychnis viscaria* (viscous catchfly), *Geranium sanguineum* (blood-hued cranesbill), *Lepidium Smithii* (wall pepper), *Scleranthus perennis* (knawel), *Mœnchia erecta*, and the two Sedums already mentioned.

About 4 p.m., the whole party re-united at a well-served dinner at the Oxford Arms Hotel, Kington. The chair was occupied by the President of the Club, Dr. Bull; and there were also present—the Vice-Presidents, the Rev. H. Cooper Key, Dr. McCullough, and Elmes Y. Steele, Esq.; the Hon. Secretary, the Rev. George Cornewall; Arthur Armitage, Esq.; R. W. Banks, Esq., Ridgeborne; Thomas Blashill, Esq., London; T. Curley, Esq., Flavell Edmunds, Esq., and T. W. Garrold, Esq., of Hereford; J. E. Lee, Esq., Caerleon, Monmouthshire; Rev. J. F. Crouch, Pembridge; Rev. E. Du Buisson, Breinton; Rev. J. H. Jukes, Preston Wynne; Rev. H. W. Phillett, Staunton-on-Wye; Rev. Charles Smith, Tarrington; Rev. Thomas West, Fownhope; Rev. Thos. Woodhouse, of Hay; J. E. Smith, Esq., of Hay; Captain Williams, Talgarth; and the following visitors:—Miss Hodgson, of Stanton Lacy; Wm. Aston, Esq., H. G. Apperley, Esq., Captain Cowtan,

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H. Cribb, Esq., W. Blakely, Esq., James Davies, Esq., and J. T. O. Fowler, Esq., of Hereford; C. Neate, Esq., Weobley; F. Nash, Esq., and T. J. Salwey, Esq., of Ludlow; A. R. Lomax, Esq., Eardisley; Rev. T. H. Bird and Mr. Bird, of Yarkhill; Rev. S. Clark, Bredwardine; Rev. E. Cunningham, Hereford; Rev. — Clay, Pembridge; Rev. J. E. Jones, Llanddewy, Caerleon; Rev. C. J. Westropp, Wormbridge, and his friend, Mr. Canning; Rev. T. Hutchinson, Kimbolton, his son, and friend, Mr. Routh; Rev. R. H. Williams, Byford; J. Morgans, Esq., Kington; Mr. Blashill, of Bishopstone; Messrs. Southall and Watkins, Ross; and the assistant secretary, Mr. Arthur Thompson.

Dinner was scarcely half over when the PRESIDENT rose and said that the time had arrived when he must begin the business of the evening, in order to get through it satisfactorily. He hoped they would continue their dinner nevertheless. When the meetings for the season were fixed at the beginning of the year, there was an impression at Hereford that the Kington meeting would be the weakest. Every one knew the great interest Bradnor Hill quarries, and the "Devil's garden" at the Stanner rocks presented to the geologist and botanist; but yet, for reasons not necessary to go into, it was thought the attendance to-day would be a small one. No sooner was it known here, however, that Kington had been fixed upon, than the excellent programme they had that day carried out was sent. If they had been desirous at Hereford to make the best arrangements they could, there was one gentleman at Kington who was more anxious still that every effort should be made for the comfort and convenience of the members who came here. If a difficulty arose, by return of post it was happily solved. Mr. Banks invited that excellent field lecturer, the Rev. W. S. Symonds, president of the Malvern Club, to give the address on Geology; and, indeed, he left nothing undone to secure a successful meeting (great applause). When all was arranged he wrote yet once again, and if the letter was opened with some fear lest a hitch had occurred somewhere, it was soon allayed—it was merely to beg our care that the salmon he had ordered for the dinner to-day should be properly sent (applause). He felt very grateful himself, and he was quite sure the club would wish him in their names to give their warmest thanks to Mr. Banks for the trouble he had so kindly taken in making the arrangements, for the attention he had given them on a day which must have been inconvenient to him, and for the excellent salmon he had so generously provided (great and continued applause). Instead of being a weak meeting it was the very strongest the club had ever held, and he thought he might safely attribute it in great measure to the esteem in which Mr. Banks himself was held (applause).

He had secondly the pleasure of at once giving, in the name of the club, their thanks to Mr. Curley for the excellent address which had been that day read to them from the heights of Stanner (applause). It was only justice to Mr. Curley to state that the cards were printed with Mr. Symonds's name attached, but the news of the interesting discovery of bones in Belgium carried

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him off there to examine them, and it was in the dilemma in which they were left that Mr. Curley, when applied to, very kindly at once consented to prepare it (applause), and he therefore all the more deserved their best thanks.

The next subject he had to bring before them was the resolution with regard to our next meeting at Ross, which had been unanimously carried at the club that morning, and that was that ladies were permitted to attend it (applause), so that however good their present meeting was, Ross was to be the meeting of the year, nevertheless (laughter). The Ross meeting would be a most interesting one, and attended with very little fatigue. They would go from the train to the boats, have a delightful two hours' row down our beautiful river, land at the Coldwell rocks, and walk over Symond's Yat to the ferry—about a mile and a half—where the carriages would meet them to convey them back to Ross.

He was happy to inform them that the Rev. P. B. Brodie, the distinguished geologist, had most kindly consented to come and give them not only a short field address on Symond's Yat, but also a short lecture on "Coal" after dinner, a subject peculiarly interesting just now. There were also several most interesting papers to be read from which a selection would be made. The following had been kindly announced:—"On the means of measuring the height of trees and other objects," by the President, with the exhibition of a self-calculating instrument, made for this purpose by Mr. Wells, of Holm Lacy; "The Lepidoptera of Herefordshire," with a special reference to the neighbourhood of Ross, by Alfred Purchas, Esq.; "Herefordshire Yew Trees," by the Rev. Thomas Woodhouse, of Hay; "The Variations of the Water Ranunculus," by Thomas Blashill, Esq., of London; and "The Elm Tree in Herefordshire," by the President. With reference to the trees, he must again call on all members of the Club to assist the gentlemen, who had kindly taken up the several trees. The Rev. Thomas Woodhouse, of Hay, would be very much obliged to any gentleman for measurements of any remarkable Yew trees in the county, or if any gentlemen did not know how to do this carefully, if they would kindly write to Mr. Woodhouse and tell him where such trees were situated. In the same way our honorary secretary, the Rev. George Cornewall, Moccas Rectory, Hereford, would be very glad to get all particulars with reference to the remarkable Oaks of the county, and he himself would be thankful to be told of any large Elms now in existence in Herefordshire.

The last subject he had to mention was that he had again received a very interesting box of orchidaceous plants from Surrey. Mr. Woods had most kindly sent him the following kinds:—A few fly orchis *(Orchis muscifera)*, several specimens of the bee orchis *(Orchis apifera)*, a few of the sweet-scented orchis *(O. conopsea)*, and some of the Helleborines *(Epipactis grandiflora* and *ensifolia)*. Now all these varieties were more or less rare in Herefordshire. He could not keep them until the present meeting, but he had carefully dried them, and should be happy to present specimens to any

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gentleman of the Club, who may be desirous to add them to their collection of plants, if they will apply to him and name the kinds they wish. It will be better for every one to name all the kinds he may want, and he would send them what he could.

The PRESIDENT, having resumed his seat, called upon one of the vice-presidents, Elmes Y. Steele, Esq., to exhibit some geological specimens which he had brought with him of a very interesting character.

ELMES Y. STEELE Esq., after proposing a vote of thanks to Mrs. Miles for her kind hospitality (applause), exhibited to the meeting an extraordinarily fine fossil, obtained a few days before from a quarry of the Old Red rock, about the middle of the eastern flank of the Scyrryd, near Abergavenny. It consisted of the shield-protected head of one of the large fishes of the Old Red seas, and was either a Cephalaspis or an Astrolepis. It was handed round for inspection, with the characteristic advice from Mr. Lee, of Caerleon, "Handle it tenderly as if you loved it," as Izaak Walton said of *his* fish. The remarkable state of preservation, and the beautiful contrast between the silvery sheen of the fish's "armour plates" and the dark red stone in which it was embodied, made the fossil a striking as well as an interesting object.

The Rev. HENRY COOPER KEY, one of the Vice-Presidents of the Club, next read the following paper.

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ON THE TWO SPECIES OF THE ENGLISH OAK,

BY THE REV. HENRY COOPER KEY, M.A.

I wish to draw attention in this paper to a subject which has not had much notice taken of it of late years, although 30 or 40 years ago a good deal used to be written about it, viz., the merits and demerits of the two species of our English oak. I am no botanist myself, and therefore I must apologise for treating upon a botanical subject in the presence of many experienced botanists; but this particular question has attracted my attention for the last 25 years at least, and I have lost no opportunity of gaining information upon it by carefully noticing oak timber on all occasions, both in a growing and dry state.

The two species of oak grown for timber in England are, as every one knows, the QUERCUS ROBUR, or PEDUNCULATA, with leaves short-stalked and not generally glossy, and acorns pedunculate; and QUERCUS SESSILIFLORA, with leaves long-stalked, larger, and always glossy, and the acorns sessile, in fact the reverse of the other; the leaf-stalk characteristic however is not constant. It is no doubt also generally known that Q. ped. is of low and spreading growth, in short very like what we call a *pollard*. Many fine oaks are called pollards, which never were polled at all, but merely follow their natural growth. The oaks at Moor Park, in Herts (all Ped.), are popularly supposed to have been pollarded by Anne, the widow of the Duke of Monmouth, after his execution. On the other hand, P. Sessil. is of upright growth, somewhat similar to the elm; and while the Ped. is exceedingly common everywhere, the Sessil. is rather rare. I think I may say that in the West of England you will meet with at least 300 specimens of Q. Ped. to one of Sessil. In the more eastern counties, such as Kent, Herts, Middlesex, and Essex, I have never yet met with a single specimen of the Sessiliflora oak. This scarcity of the Sessil. is a remarkable fact, but the cause of it is, I think, not far to seek, as we shall see presently.

Now the comparative merits of these two species, if we consult the various writers who have occasion to mention the subject, is involved in some confusion; in fact writers contradict each other point blank. One says the Q. ped. is the hardest and most difficult to work; another says it is the softest timber; a third says the sess. is liable to warp and split; a fourth says that these are the qualities of the ped., and so forth. Such contradictions as these must, I think, have arisen from a mistake in the particular specimens under notice. In a small piece of oak timber it is not always an easy matter to pronounce upon the species with certainty. But in reviewing the published evidence (at least so much of it as I have been able to meet

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with) there is a circumstance which strikes one at once, which is that the *botanists* are all upon the one side, and persons of other professions upon the other. The botanists give the superiority to the sessiliflora oak, while the other writers, and among them three civil engineers, are in favour of the pedunculata, or, at least, if not altogether, partially so; and even these contradict one another in important particulars.

In order to lay the subject more completely before you, I will give a very brief summary of a portion of the evidence I have been able to collect on both sides.

And first, as to the advocates of the Q. ped. Mr. Ranger, C.E., says the ped. is the best for lintels, sills, sash and door frames, joists, plates, rafters, &c., and where stiff and straight-grained wood is required. The sess., he says, is harder and more elastic than the other, more difficult to work, but liable to warp and split in seasoning; the strength, hardness, and toughness of this species render it eminently superior for ship-building, loch and dock gates, piles, ties, braces, &c., &c.

Mr. Cresy, C.E., says that Q. ped. cleaves easily into pales and laths, and where stiffness is required it is very useful, as it does not bend easily. Again, he says, that Q. sess. is a softer wood, and consequently yields more readily to the tools of the workmen (the very reverse of what Mr. Ranger says above). The timber, he says, is liable to warp and split in seasoning, but in consequence of its elastic properties it is highly prized for ship building, its toughness and strength recommending it for that purpose; its hardness is sufficient for all purposes where such is required. The grain of this variety bearing a strong resemblance to chestnut it is often mistaken for it; it is very durable both under water and in interiors. He says that the weight of a cubic foot of this species green weighs 80 lbs. 5oz., quite dry 51 lbs. 10oz., while a cubic foot of Q. ped. green weighs 76lbs. 13oz., quite dry 52lbs. 13ozs., showing obviously that the former, which loses more weight by seasoning, is the faster growing tree of the two; and also telling us a fact, perhaps not generally known, that green oak timber of either species is of greater specific gravity than water. I have not myself proved the experiment.

The evidence of Mr. J. M. Rankine, C.E., and others, is substantially the same as that above.

Another writer in favour of Q. ped. is the author of the work "On Useful and Ornamental Planting," published by the Diffusion of Useful Knowledge Society. He says, after speaking of the Q. sess. as the inferior species, "Although there are not such clear and specific facts recorded of the comparative difference of value between the quality of these two species of oak, as to determine the exact amount of loss which is occasioned every time the acorns of the inferior species are used for planting, instead of those of the more valuable above mentioned; yet the general opinion being so strong in favour of the superiority of the footstalked oak (the pedunculata,) that it is of much importance to collect and sow the acorns of that species only."

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Here we have a strong condemnation of the sessiliflora oak, coming from one who may be supposed thoroughly acquainted with this subject; at the same time it is obviously an opinion based merely upon hearsay evidence, and not supported by facts.

Thus we have on the one side the evidence of practical men inquiring for the timber best suited for the various purposes to which it is applied in the course of their professional practice; and if we could be quite sure that the opinions given were based upon trustworthy specimens of these two species of timber, we ought to accept them without much hesitation; but considering how easily the two species may be mistaken, the one for the other in the dry state, and in the face of the evidence given on the other side by eminent botanists and others, we may fairly suspend our judgment.

We now come to the testimony on the other side of the question, and the first instance I shall give is the writer of the botanical articles in the *Penny Cyclopædia*, whose valuable contributions are too well known to need any eulogy on my part. He says, speaking of Quercus sessiliflora, "We have already stated that the timber of this tree has been supposed, although erroneously, to be inferior to that of Q. pedunculata. Experiments as to strength and toughness have shown that there is no material difference between the two in these respects; and the durability of the wood of the sessile cupped oak is attested by the well-known fact that the roof of Westminster Hall is constructed of it, and not of chestnut, as has been sometimes said. It has been found to be the timber of some of the most ancient buildings in this country and elsewhere. An immense beam in an old house in Shropshire, now called Stonehouse, was Q. sessiliflora, and the oak usually obtained from bogs, where it must have lain for centuries, has often proved to be the same. The wood may be easily known by its medullary rays, or silver grain, being so far apart that it cannot be rent, and this gives it a peculiar aspect. Q. sessiliflora is found all over England now, but nowhere in much quantity. It is, however, more abundant in the west than elsewhere, and constitutes the greater part of the oak of North Wales. It is a much handsomer tree than the Q. pedunculata, and grows considerably faster, and therefore is by far the most advantageous for the planter."

The next writer whom I shall mention is Sir William Hooker, in whose British Flora, while speaking of the Q. sessiliflora, we find the following:— "The wood of the present species is said to be much inferior to the last (Q. pedunculata), and a general opinion having prevailed that it has been more extensively planted, especially in Scotland, no little alarm was in consequence excited lest our forests should be thereby deteriorated. An eminent modern author has however lately expressed his opinion that it is the Q. sessiliflora which yields the best timber for shipping. This subject deserves the serious consideration of the planter." The eminent modern author referred to by Sir W. Hooker is Mr. H. T. Cooper, author of the Botany of the County of

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Sussex, whose work was published in 1834. I will now read to you what he says upon the subject:—

"I may refer to the supposed difference in the durability of the timber produced by the two species of oak indigenous in this country, viz., Q. sessiliflora and Q. pe-dunculata. * * * Upon a transverse section of the trunk of the Q. ped. a vast multitude of medullary rays are found, which, by forming continuous lines from the centre to the circumference, divide the whole trunk into so many thin plates; but upon viewing a section of the Q. sess. no such appearance is found. It has been stated by many persons, and is still a very prevalent notion, that the wood of the Q. sess. is of no use, being very weak, and unfit for those purposes for which oak is usually used; and even cases of shipwreck attributed to the vessels having been built of Q. sess. have been cited by those who have spread this absurd notion in support of their theory. Even in a lecture on botany, delivered by Dr. Murta in the School of Medicine at Dublin, April 14th, 1834, I find the following statement, and quote it to show how great the prejudice is:—'Having casually alluded to forest trees, I may observe in further illustration of this point, that there are in this island two species of oak growing indigenously; one of them furnishing wood of the most durable kind, while that of the other is comparatively worthless.' * * * On the faith of such statements as these, many noblemen's grounds have been freed of the Q. sess., very great sacrifices having been made by cutting down young and vigorous trees, on the supposition that it would be folly to allow them to occupy valuable space. That the wood of the Q. sess. is of as much, if not more, value than that of the Q. ped. will be at once acknowledged, when it is learned that the piles used in the Thames, the wood found in old buildings, the wood in Westminster Abbey, &c., is all of this now contemned species; in fact all the wood commonly, though erroneously, called by carpenters chestnut, is of the Q. sess., the real chestnut wood being of a very different sort.

"To what cause the mistake may be ascribed it is difficult to say. It may possibly have obtained the name of chestnut wood from the want of the large quantity of continuous medullary rays so prevalent in the Q. ped., which are the cause of the latter being so much used for park palings, these rays giving it the property of being easily split by wedges, and obtaining for it the name of 'rent oak.'

"Besides, the Q. sess. is decidedly the most handsome tree, growing much more erect, and being of richer colour, at the same time growing more freely and with greater rapidity."

Finally, Dr. Lindley, in his Synopsis of the British Flora, says Q. sess. is as superior in the quality of its timber to Q. pedunc., as it is in beauty and vigour of growth.

The balance of published evidence seems to preponderate so greatly in favour of the Q. sess. that further quotations are, I think, unnecessary. I will only add the results of my own observation.

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The Q. ped. is that species of timber which is used for park palings, laths, &c., on account of its splitting so readily, and if any one will take the trouble to examine park paling he will find that it is invariably wedge-shaped; the lines of cleavage radiating from the centre to the circumference of the tier, along the course of the principal medullary rays peculiar to the Q. ped. When we see split oak timber in the shape of laths or poles, we may put it down at once as of this species. The Q. sess. refuses to split in this manner at all; it is more homogeneous, having no principal river of cleavage, because it has no principal medullary rays; when it splits at all it splits irregularly. Again, this easily split wood of the ped. is also more easily broken across than the other, and on examining the fracture it will be found to occur just where the medullary rays have been severed in shaping the plank. In short, this species is comparatively brittle, and the sess. is the tougher of the two. It is true the wood of the ped. is harder than that of the other, and more difficult to work, but hardness in wood is no test of strength; in fact, the hardest woods are usually the most brittle. Hardness in wood generally accompanies slow growth, and the Q. ped. is much slower in growth than the sess. But now mark the results of Professor Barlow's experiments at Woolwich on the comparative strength of slow and fast grown oak of the same species. The fast grown was deflected one-fiftieth of its length, with a weight of 606 lbs., and broken with 999 lbs.; while the slow grown was deflected by 439 lbs., and broken by 943 lbs., showing that the fast grown was superior to the other in the proportion of 15 to 14 nearly. These specimens, experimented upon, were, as I have said, of the same species, the ped.; but the experiment is of some value, as showing the great probability of the superior strength of the faster growing species, the sessiliflora.

That the sess. is by a great deal the faster growing tree of the two no one can doubt who has ever examined many specimens. There can be no question about it, and from these twigs (exhibited), which are fair average specimens of the two trees you can readily judge for yourselves. The sessil. is distinguished by its larger, glossy leaves, and its more luxuriant shoots.

And now with regard to durability. The evidence of durability of the Q. pedunc. is negative, and this is somewhat remarkable; there is no evidence at all of great durability, at least I have not been able to meet with any—by great durability I mean 300 or 400 years—and I think this is remarkable, because the advocates for the Q. pedunc. being the superior wood would naturally have furnished us with examples of this durability if such examples were to be found. I do not say that it is not durable, but only that there is no existing proof of its being so.

On the other hand, the great durability of the sess. oak is unquestionable. It was formerly supposed that the timber used in the fine roof of St. Alban's Abbey, Westminster-hall, and many noble timber roofs in London, was chestnut; it is now known for certain that it is sess. oak. The mistake arose from its going among carpenters and others by the name of *chestnut oak*, from

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the grain being like that of the chestnut, and to this day old carpenters may be heard to speak of *chestnut oak* as now no longer to be met with.

I myself, when a boy, saw some of the piles which formed the foundation of old London Bridge taken up out of the bed of the river, I think in 1831, when the bridge was being taken down; the wood was as hard as iron, and as sound, apparently, as on the day the piles were driven—more than 600 years before! And we have distinct evidence that those piles were of sess. oak.

In the year 1844 a huge canoe was brought up from the bottom of one of the small boggy lakes S.E. of Cavan, in Ireland. This canoe had been hollowed out of a trunk of sess. oak; it measured 40 feet in length, 4 feet 3 inches in diameter at the one end, and about 3 feet at the other. The tree from which it was fashioned must have measured at the least 21 feet in girth at the base, and 15 feet at the height of 40 feet from the ground. No one can say what was the age of that canoe, but some of our geologists would probably count it by thousands of years, and yet the wood was sound!

It may be considered that the timber used in our churches and dwelling houses, if of later date than the middle of the 16th century, may sometimes be ped. oak, but earlier than that is invariably sess., and with regard to large beams, I do not think you will find anywhere one of ped. of 100 years old. The great beams in the curious wooden tower of my own church at Stretton are all sess.; some of them are forty feet in length, and they are all perfectly sound, although the rain often penetrates to them.

But now, setting aside the extreme durability of the Q. sess., and granting for a moment (which I by no means allow) that the timber of the ped. is equally durable, still, in point of profit from planting, there can be no question, inasmuch as the rate of growth of the sess. is so far greater. I have searched in vain for published evidence of the fact, but fact it is. From my own observation, I believe that at the lowest the annual growth of the sess. exceeds that of the ped. as much as 5 to 4.

What, then, can be given as the reason why the Q. ped. is so universal in these islands and the sess. so rare? Why the former, with its gnarled and low spreading habit, should be looked upon as the type of the English oak by painters and poets, and indeed by every one, while the sess. is almost unknown? Is it that the ped. has good qualities which the other is without? We have seen that it has not. The fact is, the finest and best timber has been long ago used up by those who knew its value, and the inferior is left on our hands. The sess. is the *timber* tree, the ped. the picturesque; and the timber tree has been felled, while the other has been left standing. Where your population is the largest there you may expect to find fewest sessiliflora oaks, as witnessed by its scarcity in the south-eastern counties (which are timber counties), and its comparative abundance in North Wales, as I mentioned before.

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We are now actually in danger of losing, through the mere inadvertence of the landowner and planter, our most durable, our fastest growing, our most productive, our handsomest English oak. Should any one doubt its being really the handsomer tree of the two, I would direct him to the "Monarch" oak at Holm Lacy, and the giants at Tibberton, nearly 20 in number, which tower over the dwarf ped. The largest of these trees at Tibberton, was estimated, about 15 years ago, to contain 28 to 30 loads of timber, or about 1,100 feet, and it is still a vigorous and growing tree.

I do not deny, far from it, that many very fine trees of the ped. species are to be met with; the various habits of trees grown from seed are infinite, and here and there the ped. takes a more erect and, so far, a finer and handsomer growth than usual, as may be seen in the noble oaks in the park at Moccas; but that which I maintain is that the sess. oak stands alone as a *timber tree*, superior to all in its glossy dark-green foliage, its handsome form, its rapidity of growth, and the extreme durability of its timber; and this noble species we are well-nigh losing out of thecountry.

Our President has kindly sent me a carefully compiled list of the finest oak trees in this county—not certainly a complete one, nor pretending to be so—and he has marked the species of each tree. I find in the list 31 specimens of the pedunculata, the ordinary oak of the country, and 14 of sessil.; and if to these last we add the 19 magnificent trees at Tibberton (which he does not mention, but which are probably not to be surpassed in the same space anywhere in England), we have 33 fine oaks which are sessil., *the rare species*. This circumstance is significant.

I cannot help, therefore, appealing to the members of our Woolhope Club on behalf of this now rather scarce tree, and urging them to impress the importance of propagating it upon all whom it may concern. To the nurserymen the species is unknown: with them an oak is an oak, and it matters nothing to them from what tree they get their acorns. The question seems to me one not only of *interest*, but of some *practical importance*, for, although we live in an age when iron is superseding timber to a great extent, yet it never can supersede it altogether; and probably there is now as much call for oak timber as ever there was. It seems to me a matter of so much importance, that I almost think I may appeal, not merely to our individual members, but to the Club itself, as a Club, to advocate the planting of the sessiliflora oak by such means as may lie in its power (applause).

The PRESIDENT said the Club was much obliged to Mr. Key for the very interesting and important paper he had just read to them. The time would not permit them to enter into any discussion upon it now, but the best way, perhaps, to call attention to it for the present would be to publish it in the columns of the *Hereford Times* newspaper, and in the transactions of the Club (applause).

The President then read the following paper.

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ON WANDERING PLANTS, WITH RECENT EXAMPLES.

BY DR. BULL.

The native flora of every thickly-populated country must ever be gradually changing. Some plants disappear before drainage and cultivation, whilst others which have been introduced become naturalized, and spread through the land. Indeed it is but the repetition of an old tale from a botanical aspect. Wherever man himself has wandered from one country to another, he has ever carried with him the objects he has found useful, or to which from old associations he had become attached, and is ever seeking to surround himself with others that may minister to his comfort or add to his pleasure. Thus trees and flowers and plants of various kinds have been brought to this country from time to time, and many of them have thoroughly established themselves here, until now, even in Herefordshire, our club can no longer take a botanical ramble without meeting many plants which do not properly belong to the British flora. If we overlook the long-established forest trees; if we stop only to admire the numerous ornamental trees which are so continuously introduced; if we pass by the many flowers wanderingfrom gardens; or the shrubs, that becoming naturalized have strayed over the country; we shall still find numerous examples to attract our attention amongst the ordinary insignificant plants of the cornfields and hedgerows—plants which have been introduced accidentally, and which liking the climate and soil of their new country, make themselves completely at home, and thrive and flourish—ripen their seeds, and otherwise propagate themselves with perfect freedom and independence.

These introductions have taken place from the earliest times—from times quite pre-historic, botanically speaking—but of late years the increased facility of communication and the great increase in trade with foreign countries has added greatly to their number, and often brings us plants—wanderers from more southern climates—which can only flourish for the summer season of their introduction.

Forest trees were doubtless amongst the earliest to be introduced, and several of those now most familiar to us in our lawns, and woods, and hedgerows are simply wanderers from cultivation. The *Ulmus campestris*, the so-called "English elm," is a very doubtful aboriginal British tree, though it is now usually considered so, and Mr. Babington goes so far as to say that the common *Hawthorn* is also an introduced tree. The *Yew*, the *Box*, the *Beech*, the *Lime* trees (*Tilia intermedia* and *parviflora*), the *Hornbeam*, the *Sycamore*, with several of the *Willows* and *Poplars*, and some other trees, though admitted into the British flora under protest, that is to say, in italics, are certainly introduced trees; whilst the *Spanish Chesnut* (a tree, by-the-way, certainly brought into this country in those pre-historic times to which I have alluded), the *Walnut-tree*, the *Plane-tree* (*Platanus orientalis* and *occidentalis*), the *Horse Chestnut*, and many coniferous and other trees, are not even mentioned in the British lists.

Wanderers from the Garden, however, form the most numerous band of naturalised plants. In Herefordshire the *Columbine*, the *Globe Flower*, the *Soapwort*, the *Lungwort*, and some others, now recognised as British, belong to this category—as certainly do the

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wall-flower, the *snowdrop*, the *Narcissus pale* (*Narcissus biflorus*), the *star of Bethlehem*, the *Periwinkle* (*Vinca major* and *minor*) the greater *snap dragon* (*antirrhinum major*), the *ivy-leaved toad flax* the *evening primrose*, the *honeysuckle*, the *stonecrops* (*Sedum album* and *S. dasyphyllum*, and perhaps *S. reflexum*), the *house-leek*, the *cranesbills* (*Geranium phœum*, and perhaps *G. columbinum*), the *leopard's-bane*, the *cross-leaved bed-straw*, the *St. John's wort*, (*Hypericum calycinum*), the *red valerain*, the *wild sage*, or *clary*, (*Salvia verbenaica*), the *motherwort*, *Jacob's ladder* or *Greek valerain*, the *dame's violet*, and some others.

Several of our Herefordshire plants are wanderers from the kitchen or herb garden, as the *horse radish*, the *horehound*, the *hellebores* (*Helleborus fœtidus* and *H. viridis*), the *opium poppy*, the *celandine*, the *thorn-apple*, the *peppermint*, and the *carraway*.

Agriculture has also introduced plants which have quickly naturalized themselves and spread over the country as the *Dutch Clover*, the *Italian Rye-grass*, *Saintfoin*, the *Field Cabbage*, *Cole seed*, the field *Melilot*, the *Vetch*, *Rye*, and *Brome grass*, the *Dyer's woad*, the *Medick*, and some others.

All these naturalized plants have been designedly introduced for some special virtues or properties of their own; but there is yet a large class of other plants that owe their English residence to accidental circumstances. How some of them came it is impossible to say. The home weeds of the farmstead, the *docks*, the *goose-foot* tribe (*Chenopodiæ*), *thistles*, *wormwood*, *mallows*, &c., &c.; those of the garden and cornfield, *chickweed*, *groundsel*, *chamomiles*, &c., &c., accompany civilisation, and may thus be said to follow the footsteps of man wherever he goes. No doubt some of these, and many others, have arrived by their seeds being accidentally mixed with some imported seeds, or perhaps they may have been brought over in the packages of commerce, and many of them have wandered widely through the country. It is probable that with foreign seed came originally all the *poppies* (*Papaver Rhœas*, *P. argemone*, and *P. dubium*), the common *fumitory*, and the *field Ranunculus* (*R. arvensis*), and several others now recognised as British. More recently the *Lamb's Lettuce*, the *Pennycress*, the *Pepperwort*, the *Parsley*, the *Dog Mercury*, the *beaked Parsley*, the flax and clover *Dodders*, (*Cuscuta epilinum and C. Trifolia*), have established themselves here, and are admitted in italics to the British lists. The American, or rather *Canadian water-weed*, (*Anacharis Alsinastrum*) which spreads so rapidly through our streams—and nowhere more plentifully than in Llangorse Lake—is supposed to have been brought over bodily with American timber—although Mr. Babington who carefully propagated it in the Botanical Gardens at Cambridge, and thus spread it through that county, has been much quizzed about its introduction. It is a curious fact that, according to Dr. Torrey, the Italian plant *Valisneria spiralis* has made the same inroad on some American rivers —the Hudson in particular—as the *Anacharis* has done in this country.

The particular examples of wandering plants which I now wish to bring to your notice, belong to this last class of foreigners—that is, to plants accidentally or mechanically introduced.

The *Veronica Buxbaumii*, which has now become thoroughly naturalised in England, is a comparatively recent introduction. It was first observed in England in the year 1826, and was doubtless brought over mixed with foreign corn, or clover seed. It seems as hardy, and issues its seeds as freely as any of our common native veronicas, and is a more elegant, beautiful plant than most of them. It was first observed in this county, in the neighbourhood of Ross, by Mr. Purchas, in 1850; and in 1852, at one of our Club meetings, it was found growing very freely on the Croft Castle estate, particularly in the field of that noble grove of sweet chestnut trees. Since that time it

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has become very common in several localities—Ewyas Harold, Holm Lacy, and Holmer—and has evidently taken up its permanent residence here. In one place, however, at Holmer, it has disappeared again, so that it still remains an interesting subject for observation. (Fresh specimens of the plant were handed round the room.)

The next plant I present to you is the *Blitum virgatum* (Willdenow), or small *strawberry blite*. Mr. Purchas found this plant at Ross in 1853, when the turf of a portion of the Prospect was dug up and planted with potatoes, and it was thought to have grown from buried seeds. The ground, however, was shortly afterwards laid down for turf again, and it disappeared. The strawberry blite is a native of central or southern France. It is an annual or biennial belonging to the family of Chenopodiæ, and has the usual insignificant flower of its order. In fruit, however, it is extremely graceful and pretty, and when fresh is so highly coloured as closely to resemble small strawberries. Mr. Steele, who sent me this specimen, found it in the year 1861 in the corner of a field on the outskirts of Abergavenny, and supposes it to have been brought there by the manure cart from a garden mixen. He quite failed, however, to trace its origin. He could neither find it in any of his neighbours' gardens, nor did any of the gardeners themselves know it. Mr. Steele, with his usual energy, had the plant taken up and removed to his own garden, where it has re-appeared, abundantly self-sown, every year, so that it may readily become naturalised. He has no doubt but that it would make an excellent spinach, and it is possible that it may have been introduced for this purpose.

I have now lastly to call your attention to a wanderer from still more southern regions, which appeared at Hereford last year. It is a remarkably rough specimen of a delicate plant. In the beginning of September, 1865, the *Xanthium Spinosum* was found growing in two localities at Hereford. It was first found flourishing on the site of the Old Mill between the Castle Green and the garden of the Infirmary. There were not less than 33 plants scattered widely over about a quarter of an acre of waste ground, contending for space with *mallows*, *docks*, *nettles*, *wormwood*, and various members of the *Chenopodiæ* that abounded there, and holding well their own. Three plants were afterwards found growing together in an uncultivated cottage garden on the same side of the city, but about a quarter of a mile distant from the first locality. The *Xanthium Spinosum* (Willdenow) or *Spiny Burweed*, or *Burdock*, is a monœcious plant of the natural order Compositæ, sub-order Ambrosiæ. It is an annual, and very common in the South of Europe. Its congener, the *Xanthium Strumarium*, the *smaller Burweed*, has long been admitted in the catalogue of British plants; but the occurrence of *Xanthium Spinosum* in England has not been previously recorded. Specimens were forwarded to Mr. Oliver, at Kew Gardens; Messrs. Babington, Watson, Boswell Syme, and some others; but none of them were aware of its having been found here in a wild state, and all unanimously, of course, regard it as quite accidental, and as not in the least likely to become naturalised. However, on sending a specimen, as in duty bound, to our then president, Elmes Y. Steele, Esq., of Abergavenny, he at once recognised it, having found it in 1857 growing vigorously on a ballast heap at Newport, Monmouthshire.

"A very interesting plant," said one botanical friend, "but I am thankful it is not British, and fervently hope it may never become so." Indeed, as you see from the specimens presented, it is so very unattractive that it is the more difficult, for this very reason, to account for its occurrence in such abundance at Hereford. It is impossible to consider it as a garden wanderer, or as coming mixed with other seed, and it is extremely improbable that it should have been brought designedly in any way. The most

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XANTHIUM SPINOSUM (Willd).

Spiny Burweed, or Burdock.

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reasonable explanation seems to be this: the waste ground on which most of the plants were found had been used during the spring months for pitching the contents of the city mud-carts; and if we suppose that the seeds had come accidentally in the packages of merchandise from the south of Europe, its mixture with the street sweepings would be easily accounted for, and once thrown on the waste ground, the hot summer and autumn of 1865 would readily encourage their growth. This explanation, however, does not meet the fact of its appearance in the uncropped cottage garden, where, so far as appeared, no street sweepings had been thrown. Some of the plants ripened their seed, and it will be curious to observe whether it will again make its appearance this summer. There is one circumstance against it, and that is that most of the waste ground where it grew has been added to the infirmary garden, and has been raised three or four feet from its former level.

Some five years since Mr. Edwin Lees read a paper on the *Anacharis Alsinastrum* before the Cotteswold Club, and continued his observations to the introduction of plants in general to the Flora of Britain. Since he was unable to be present with us to-day, he has kindly placed his MSS. in my hands with free permission to use it for the conclusion of the present communication: a permission which will most certainly give to this paper the character said to belong to ladies' letters, wherein the chief and most interesting portion is always contained in the postscript. After a single quotation peculiarly his own, I shall, for the sake of better adaptation, use my own arrangement and often my own words in appropriating the chief part of his very interesting paper.

"If we strike from the British Flora," says Mr. Lees, "all the plants that have come in since the Celtic colonization, hundreds would be lost to us. Our own island was not the centre of vegetable creation, and I can only admit the true ancient Britons, indigenous to our present rocks, to have been the humbler tribes of *Algæ*, *Mosses*, and *Lichens*. These we may admit

"True natives to the manner born,"

the only genuine colourers of the rocks, which had no painted robe of beauty of much greater thickness than that

"Prince Vortigern had on
Which from a naked Pict his grandsire won."

Such was the true native vesture of this country, and its present robe of green and floral adornments are all of exotic origin."

Without going quite so far as this, however, we may be sure that from the earliest times, whenever man has migrated from east to west, various plants have accompanied him—some he has gladly carried, whilst others have clung to his robe and sprung up in his path against his will. Go where he will the various *docks* will spring up around him, *groundsell* and *chickweed* or *choak-weed* will grow in his gardens; *plaintain* and *butter-cups* will appear in the grass; *fat hens* or the *chenbpodiœ* will cover the rubbish heaps; *sow-thistles*, *poppies*, *chamomiles*, *corn flowers*, *ox-eyes*, and numerous other "furrow-weeds" will shoot up in his corn fields; whilst everywhere the universal *nettle* makes its appearance. The nettle, though really of extraneous origin, is now so abundant everywhere in England that Watson in his Cyb. Brit. has made it one of the features of our indigenous flora.

Every nation that has landed on our shores has contributed something to our present accredited flora, though in the majority of instances we may not now be able exactly to trace the giver.

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The Romans, perhaps, more than any other people, have enriched our fields. It is generally believed that to them we owe the introduction of the *elm tree*, which now forms so striking a feature in the landscapes of this country. It is most probable, too, that the Romans introduced the *box tree*, and it is certain that they brought the *cherry*. Lucullus carried it from Asia Minor to Rome, and history states that it had reached Britain before A.D. 150. "All our wild cherries have been propagated by the birds from the cultivated one, and the bird cherries of the woods are simply degenerated cherries from the garden." The *Roman nettle* haunts yet some of the ruined Roman stations, though not in Herefordshire, and perhaps the coarse pot-herb, *Alexanders (Smyrnium olusatrum)*, generally found near or upon their earthworks, was used either by the soldiers of Rome or their auxiliary German bands. It is quite possible, also, that the Romans first introduced the *Spanish chestnut*, and the *walnut tree*, of which we know they were very fond, and the *yew tree*, if this last really is an introduction; for few botanists who know its frequency in the hanging woods on the banks of the Wye, in Surrey, and many other places, would regard it in the character of an alien.

The Danes are commemorated in the *Danewort* or *Danesblood (Sambucus ebulus)*, which was said, curiously enough, to spring up wherever their blood was spilt. Even Worsaae, a grave historian, in his "History of the Danes in Britain," relates that after the siege of Warwick by King Canute an enormous quantity of *Sambucus ebulus* sprang up around that town, and was commonly said to have grown from the blood of the Danes. Whatever we may think of the legend, we may perhaps take the fact, that this shrub was brought to Britain in the train of the Danes.

The Saxons brought us the *Beech* tree, at all times graceful and beautiful, but in autumn, with its rich and varied tints, perhaps the most beautiful tree we have. They are said to have brought it for its *mast* to feed their enormous herds of swine They called it *boc* or *buch*, and so the salted flesh, flavoured by the *buch* or *beech mast*, was said to be *buchon*, now corrupted to *bacon*. Buckinghamshire took its name from the beech woods planted there, and so with the Buckhursts, Buckholts, &c., &c.

The Normans, after their sword had won the country, introduced a better kind of apple, for the Saxons appear only to have known the crab that

"Hissed in their bowls when roasted!"

And they probably added greatly to the number of ordinary British plants, by the foundation of numerous Monasteries and Nunneries. From the gardens attached to these institutions many plants might readily wander through the country. The monks, hermits, and nuns in the early ages of Christianity, "bound, in many instances, by their vows to live on vegetable diet, a garden was indispensable to their purpose, while the calls of the peasantry on their medical skill required the cultivation of such as would furnish them with decoctions and balms for the protean forms of disease, as then understood and encountered. But, independent of this, amusement was required to unbend the mind tired with the sameness of austerity; and nothing could surely be more innocent than the cultivation of that love for flowers which all mankind possess, bent as it was presumed to pious uses, by connecting the names of the Virgin and saints, and the recurrence of festivals, with the appearance of the varied blossoms of the year. In the old oratory gardens, were a host of disease-destroying plants, which as *wound-worts, heal-alls*, or *loose-strifes*, effected wonders in their day, and were *balms* for all possible ailments, though now abandoned and neglected. Even in later times, certain plants have obtained celebrity for some fancied power or property, and so been spread about. Such, according to Willdenow, has been the case with the common *Thorn-apple*

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(*Datura Stramonium*), which is now scattered throughout the greater part of Europe as a noxious weed, but was brought originally to us from the East Indies and Abyssinia, and so followed the steps of a set of quacks, who used its seeds as an emetic or cathartic. Probably many plants have been accidentally carried about in this way, and assuredly others have been purposely planted."—*Lees' Botanical Looker-out.*

"Thus *Senecio squalidus* remained a great number of years on old walls, near Worcester Cathedral, a former member probably of the convent garden, and yet existed in 1849. The same plant grows abundantly, on walls at Oxford, escaped from the physic garden there. *Atropa Belladonna*, although now naturalized among the stony hollows of the Cotteswolds, in Gloucestershire, and in other neglected spots, is a lurid plant, certainly derived from the monasteries, and it now flourishes in such profusion, near Furness Abbey, Lancashire, that the "Vale of Nightshade" has been appropriately applied to the spot. *Aristolochia clematitis*, having a celebrity for female complaints, was cultivated in the gardens of nunneries, where, from its abiding roots, it is still to be met with at the ruins of such structures as Godstow Nunnery, Oxfordshire, from whence I have a specimen. Such *historical* or *memorial* plants have a peculiar interest, and deserve to be noted, though there can be no necessity for insisting, as some botanists do, that they are "certainly wild,"—meaning thereby that they had an *ab origine* existence in our island."—*Ibid.*

To this source we are also probably indebted for the *Barberry*—so much used of old in confectionery—the *eye bright*, the *wall flower*, the *ivy leaved toad flax*, and many other of the plants before mentioned. A botanical ramble around the site of an old abbey or monastery to this day will almost always afford some interesting plants not common in the district.

The Flemings, who were brought in as colonists by some of the Norman monarchs to occupy parts of South Wales in the reigns of Henry I. and II., seemed to have been particularly fond of the *narrow leaved mustard (Diplotaxis tenuifolia)*, for this plant now covers the old walls and ruins where the Flemings once resided. It is especially common—amongst other places—in Tenby and the neighbourhood, where every "coign of vantage" on the low picturesque houses is covered with it.

Many instances, amongst the plants already pointed out as "Wanderers" into the British Flora, might be given to illustrate the influence of modern international communication in the introduction of fresh plants, but it is not necessary. The rule is a general one, and applies to all countries. If America has given us the *Anacharis alsinastrum*, the *Œnothera biennis*, the *Erigeron canadensis*, the *Impatiens fulva*, and several other plants, it has received and has heartily welcomed from Europe a host of others in return, insomuch that Sir Charles Lyell has called New England the "Paradise of European weeds." From the little *knot-grass*, that Dr. Terry says abounds in the vicinity of New York, to that rankest of our arable weeds, the common *black mustard*, which Professor Buckman found towering on the banks of Ohio—in short, wherever clearings are made in the primitive forest and corn fields are introduced, there the European agrarian weeds quickly appear in abundance.

A curious example of the unconscious persistent attendance of certain plants on man is afforded by the fact that the little *waybred* or *plaintain* (Plantago major) was called by the Indians "Englishman's foot," because they always observed it to spring up wherever the English had encamped.

I will give but one other illustration, and it shall be from the Antipodes. In Australia, wherever sheep farms are established, the *buttercup*, the *horehound*, the *thistle*, and other plants of British origin immediately begin to appear; indeed, as you

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are doubtless aware, the thistle has increased to such an extent in South Australia, that an Act has been passed for its extirpation. Whether it will be effectual to destroy it seems problematical, for a worthy Scotchman of the colony (or more probably a facetious friend for him) thus recorded his protest against the bill:

"'Tis idle wark, as time will show
To root the bonnie plant frae ground,
For nature still mak's thistles grow
Where cannie Scots are to be found."

Dr. Bull resumed his seat amidst general applause. There was no time to comment on this most interesting and suggestive paper, every page of which affords ample matter for discussion, and sometimes even for disputation. In that very excellent and entertaining book, "The Botanical Looker-Out," by Mr. Edwin Lees, much additional information on the subject is very happily given. This badly named book, as the President remarked in conversation, is not half so well known as it deserves to be. It is full of sound practical knowledge, conveyed in a most original and interesting manner, and cannot fail to be most useful to all young beginners of botany. There was no time however for discussion; the President had read against time with his watch in his hand, and as he finished the carriages arrived at the door, and the meeting immediately broke up.

About 6 p.m. the company separated, the President and a large party returning by coach to Eardisley, and thence by rail to Hereford, which they reached about 7 p.m., having spent a very delightful day.

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The Woolhope Naturalists' Field Club.

MEETING AT ROSS,

JULY 27TH, 1866.

The third meeting of the Woolhope Club has been most successful. A dull, cloudy sky for many days before, a sinking barometer, and a sudden change of the wind to a southerly quarter, were certain indications of approaching rain, and caused some fears lest the day should prove unfavourable. Ladies had been invited, and fine weather was all the more desirable. At 8 o'clock a slight shower occurred, which, though it may have prevented some of them from coming, enabled others to show a faith in the good fortune of the club, that met with its just reward in a very enjoyable day. Members and visitors began to arrive at the Barr's Court station by halfpast 9 o'clock, and before the train could start an extra carriage had to be put on. Already the club assumed an unwonted air of gaiety—the members were observed to take first-class tickets—the pretty hats of the ladies and the little baskets they mostly carried, though they might be intended for ferns or fossils, were eminently suggestive of a pleasant pic-nic; the geological hammers were of course unmistakeable; but as to the botanical boxes, the proximity of parasols created the strongest suspicion that biscuits or sandwiches were the only "specimens" they contained. The train soon sped onwards to Ross, picking up at the several stations additions to the party. In this short distance the railway crosses the Wye no less than four times, and always so directly that at each time you seem to bid the river farewell. But no! Whether you shoot by woods or past meadows, in cuttings or through tunnels, there you find it again and again; and more than this; for sometimes on one side and sometimes on the other, it gracefully approaches the line, as if for the mere object of adding its own beauty to the scene. The Wye, says Drayton—

> To Ross her course directs; and, right her name to show,
> Oft windeth in her way, as back she meant to go.
> Meander, who is said so intricate to be,
> Hath not so many turns nor crankling nooks as she.

Nowhere, perhaps, are its wanderings better seen than from the beautiful pleasure grounds of the Royal Hotel. Not that the Hereford party saw the Wye there at this time, for as the train reached Ross, spots of rain

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left long streaks on the carriage windows, and small watery clouds hung threateningly over the beautiful woods of the Chase. There was no time, happily, for gloomy forebodings; the train had arrived, and the bustle of getting the ladies into the carriages and walking off to the boats made every one forget to be afraid. At Ross the honorary secretary, the Rev. G. H. Cornewall, and many other gentlemen and ladies joined the party. The boats were all in readiness, and as each received its passengers under the immediate superintendence of the President, it started on its journey; and so went off the "Pyrene," the "Niobe," the "Jenny Lind," and the "Nightingale." As each boat left, a captain for the day was appointed, and his paper of instructions, in all due form and fun, given him, "to be acted upon" below Wilton bridge. The President remained to complete the instructions, but in a smaller boat he soon overtook the party.

The ruins of Wilton Castle, which form so pretty an object in the view from Ross, were soon passed. Its solitary tower and grey walls are now in the gardens of a private house, and may not be visited. Three centuries ago the river flowed past them, but it is now, by a gradual change in its course, nearly 200 yards distant, and apparently at a much lower level. Immediately below the bridge the river is very shallow, and here it was thought some of the heavily-laden boats might have got aground. There was water sufficient, however, and making their way through wide beds of the large water crow-foot, they passed safely over. This Ranunculus *(R. Fluitans)*, with its fine white blossoms, is rather rare. It is peculiar to rapid streams, and is nowhere more plentiful than in the Wye; its flowers were very abundant and pretty, and attracted universal attention. The weather had now become everything that could be desired to enhance the natural beauty of the river, a soft wind from the south, a clear atmosphere, and the absence of the hot sunshine made the row down most agreeable—Goodrich Court and Castle were soon reached. "May we land and see the ruins?" the President was asked, as he passed one of the larger boats, and the request was supported by others, but he was inexorable, "certainly not" was the answer—and it was right, for the ruins require and deserve a day to themselves, not for the Woolhope club, but for a pic-nic party. The grand old castle stood a memorable siege in 1646 under Sir Henry Lingen. From March 10th in that year to July 31st it held out bravely against "Col. Birch with a party of horse and foot from Hereford, with Col. Kyrle's body of horse and dragoons, and Captain Rumsey's firelocks from Monmouth." By battering guns, and by mining, a breach was at length effected, and the castle taken. A small garrison was left in it, but the following year it was ordered by the Parliament "that Gutheridge Castle be slighted." Its fortifications were then demolished, and it has never since been occupied.

Time, Time his withering touch hath laid
On battlement and tower;
And where the banner was displayed
Now only waves—a flower."

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So Goodrich Castle was passed, and the boats slipped on down the beautiful river, now disturbing the sandpiper *(Totanus hypoleucos)*, which flew off wildly with its piping cry, and now the moorhen or the water vole, which, however, bore the interruption much more philosophically. It was pleasant to see so many kingfishers there *(Alcedo ispida)* flying rapidly away in a straight line, their brilliant blue feathers contrasting well with the masses of coloured flowers on the banks. There was also observed a single water ouzel *(Cinclus aquaticus)* with its white breast as it flew by in a straight line to settle again on a rock at some distance. It had doubtless left its mountain streams for a visit to the kingfishers on the greater river.

Speaking of fishers, it may be observed that in two or three places below Lydbrook *walls were built out into the river*, in such a manner as to render the escape of the poor salmon up the river a matter of great difficulty when the nets which were hanging out to dry were in constant use. It is to be hoped that the Wye Preservation Association will look a little more closely into this matter. It is but a very short time since the existence of these walls was actually denied.

The wild flowers on the banks were in great perfection, and they form one of the attractions of the Wye. No one could fail to be struck with the abundance of the tansy *(Tenacetum vulgare)*, with its dense heads of golden flowers, contrasting so well with the large spiked clusters of the purple loose-strife *(Lythrum salicaria)*, and so well relieved by the dense white masses of the common yarrow or milfoil *(Achillea millefolium)*, or the still more pure white heads of the sneeze-wort or goose-tongue *(Achillea Ptarmica)*, which, although by no means a common plant, is abundant on the Wye. In several places, a large cluster of the soapwort *(Saponaria officinalis)* was beautifully in flower, and its conspicuous pale rose-coloured blossoms could not fail to attract attention. This is a very local plant, but it was observed to be growing freely in four or five places. Then there was the great yellow loose-strife *(Lysimachia vulgaris)*, so clear and distinct in its colour, always an interesting plant, and very rare in more northern counties. This plant owes its name to its supposed power of destroying noxious insects, and even taming wild beasts—

> Yellow Lysimachus, to give sweet rest,
> To the faint shepherd, killing, where it comes,
> All busy gnats, and every fly that hums.
>
> —*Collins.*

And this idea seems to account for the Roman notion that "these flowers put under the yokes of oxen kept them from quarrelling with each other." Another pretty plant also deserves especial notice, the flowering rush *(Butomus umbellatus)*, which appeared very plentiful in many places down the river.

> Her rosy umbels rears the flowering rush,
> While with reflected charms the waters blush.

It is very ornamental, and might be grown much more frequently than it is in the ponds or small pieces of water in pleasure grounds. Mention must also be made of the abundance of meadow-sweet, and the handsome reed-beds

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that lift their heads so gracefully, whilst the beautiful forget-me-not and the yellow-cress appeared wherever space could be found, to ornament the banks. The beautiful sprays of the purple vetch, the noble blossoms of the large white convolvulus (how this would be prized if it were only exotic), and the lychnis, the comfrey, and numerous other plants which always delight the eye of a botanist, or recall some old associations.

A flower is not a flower alone,
A thousand sanctities invest it,
And as they form a radiant zone,
Around its simple beauty thrown
Their magic tints become its own,
As if their spirit had possessed it.
—*Douglas Allport.*

On went the boats by the pretty village of Walford, between the Leys-hill and the Coppet Wood-hill, under the Kyrne bridge, past Lydbrook, until the fine rocks of Coldwell stood up boldly from the woody steeps, and were commanded by Symond's Yat at the end. At the foot of the slope the several passengers landed, and began the ascent through the woods to the Yat. The President and his companions had been the first to arrive, then came two other boats, but where were the rest? After a long half-hour, one appeared round the corner, and the other quickly followed it. Happily they had not met with any casualty, but had stopped to see the church of Welsh Bicknor. The ascent to the Yat was soon made, the whole party being meanwhile subjected successively to the systematic begging of officious old women insisting on rendering unnecessary services, and children offering unripe apples, &c., &c., common to all "the pretty places which ye English do frequent." They had no sooner reached the summit than a flying cloud passed over, and a sharp shower of rain sent everyone off to shelter under rocks or under trees, as best they could. In a few minutes it had passed over, the whistle-call sounded, and the party assembled, to listen to the following address :—

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COAL: ITS GEOLOGICAL & ECONOMICAL HISTORY.

By the Rev. P. B. BRODIE, M.A., F.G.S., Vice-President of the Warwickshire Naturalists' Field Club.

After stating that the geology of the surrounding district had been so fully and ably described by his friend Mr. Symonds, that it was quite unnecessary for him to enter generally upon the subject, he said he would take advantage of being in the immediate neighbourhood of the interesting coal field in the Forest of Dean to confine his observations to the geological history of coal. Mr. Brodie then gave a brief sketch of the carboniferous series of rocks, which consist of alternations of limestone, sandstone, shales, and iron stone, with subordinate bands of coal. Under the coal itself, in most cases, there was a bed of clay, called "fire clay," because it was impervious to heat. Coal was based generally on the mountain limestone, and deposited in limited areas, but the Dudley coal field was an exception, and rested immediately on the Silurian rocks. The Forest of Dean coal field was a very small one. The Shropshire was larger, and the Dudley coal field larger still. The South Wales coal field was very extensive, and the Northern the largest of all. In Dean Forest, between the lowest coal seams underlying the millstone grit, are about 800 feet of green sandstones full of the remains of plants, and the regular coal overlies them. Sections may be seen at Drybrook and on the railway, near Sudley. The deepest coal mines are those of Northumberland and Durham, some of which are 300 yards, or 900 feet below the surface. The thickest bed of coal is the main coal in Staffordshire, that of Dudley, which was thirty feet in thickness, but as a general rule the strata of coal are much thinner, not more than from three to five feet. The Derbyshire coal measures yield about thirty different beds of coal, varying from six inches to eleven feet in thickness. The South Wales coal field was about 100 miles long and 25 miles broad. The entire thickness of the carboniferous series was about 15,000 feet, and if all the various beds of coal itself were placed together they would amount to about 2,000 feet in thickness; but of course all these beds did not appear togetherin one locality, or if they did were not approachable. Some geologists think that all these coal fields were at one time connected together; others that they were separate and independent deposits, partly lacustrine, fluviatile, or marine; that England was a series of islands formed by sinking coral reefs of mountain limestone, and that coal was deposited over them, and that they were afterwards separated and broken up by volcanic action, causing what are called "faults" in all directions. After the deposition of coal volcanic disturbances were taking place with

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great intensity, and the igneous rocks then driven up through the strata proved the force with which they acted; a fine example of which may be observed in the coal field at Clee Hill, in Shropshire. These "faults" are very numerous, and the coal beds were downcast or upcast according to the circumstances of each. These "faults," in many cases, brought the coal to the surface, otherwise we should never have been able to get at it. The denudation in the valleys consequent also upon the volcanic disturbances, by washing away the upper rocks, often brought us nearer the coal measures. Sometimes, indeed, the coal itself was washed away, as was the case probably in this county. A great part of Herefordshire may at one time have been covered by the carboniferous rocks and the coal measures; but the denudation caused by the great volcanic disturbances which threw up the trap rocks of the Malvern hills washed them all away, and left the still older rocks, the Old Red Sandstone, at the surface. There are several varieties of coal. 1. The bituminous or caking coal, like the Newcastle, composed of bitumen, charcoal, and a little earthy matter. 2. The anthracite or stone coal, like most of the Welsh coal, which is almost plumbago itself, and emits no smoke. 3. The lignite. 4. The cannel; and 5. The culm or slaty coal. We must remember also that the diamond is supposed to be crystallized carbon, or coal in its purest form. Amber and jet are also forms of coal. The best coal was always the blackest, that is, composed more purely of bitumen and carbon. Besides the coal of the true carboniferous series, there was undoubtedly coal in other formations, as in lias, oolite, &c.; but it was impure in quality and generally small in quantity; and there were also extensive deposits of tertiary coal in Germany, Prussia, North America, Australia, and New Zealand.

With reference to the origin of coal it was composed, as they all knew, of vegetable matter under a peculiar chemical condition, from the combined action of heat, submersion, and of great and long continued pressure. The heat was not necessarily tropical, but the warm, moist heat of a climate like the Brazils. The plants were mostly of a succulent nature and of a peculiar character. They were Monocotyledonous plants, or Endogens, and so much changed and compressed that generally it was very difficult to get good, or complete specimens. There were numerous tree ferns—*Pecopteris*, *Odontopteris*, *Neuropteris*, &c.—the *Lepidodendrons*, trees partaking of the character of pines and club mosses, the beautifully-marked *Sigillaria*, and their numerous roots, (called *Stigmaria*), *Calamites*, *Pines* and *Palms*, &c. The trees now so numerous on the earth had then no existence, and those of the coal formations in themselves pointed out a peculiar atmosphere and a high temperature. The chief constituent element of plants, as they knew, was carbon, which either previously existed, or was formed by vegetation from the simple elements of the atmosphere, and the time it must have required to form such enormous coal-fields was almost inconceivable. Much carbon must of course have been evolved during the period. Heat, pressure, and submersion continued for

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ages, and thus the associated clays were turned into shales, and the plants converted into coal. Besides vegetable remains, the coal measures contained numerous other fossils, sauroid fishes, with powerful jaws and teeth, as large as crocodiles; and various examples of the shark tribe, with some reptiles of a low class, *Archegeosaurus*, &c., mixed more or less with marine and estuarine shells. Land shells were very seldom found, which militates rather against the lake theory of the coal formation. Dr. Dawson, of Montreal, from the fact of the occurrence of such an abundance of *stigmaria* (roots of the *sigillaria*) in the "under clay" which is found beneath all coal beds, contends that the coal was accumulated by growth, *in situ*, and not drifted there, the clay being formed by the transportation of the mud and sand by water, conditions which may now be seen to prevail in the swampy deltas of great rivers. The cannel coal and earthy bitumen, he states, are of the nature of the fine vegetable mud which accumulates in the ponds and shallow lakes of modern swamps. Fresh water shells are very rarely if ever found, but Dr. Dawson had found a *pupa*, a land shell, and many small reptiles, in the hollow trunk of a sigillaria. It was a very small shell, but it was a very important fact. Insects had also been detected in the coal, but they were exceedingly rare in the English series. A fossil spider had been met with in Germany in a very perfect state, the round full body, the legs, and palpi all beautifully preserved. Scorpions and various other insects had also been found in the coal shales. A knowledge of the different formations in connection with coal was of the utmost importance, ordinary miners judge so commonly from appearances on the surface that they were always liable to be deceived themselves as to the probability of finding coal, if they did not sometimes wilfully deceive others, as he believed they did. Near Wenlock, for example, a gentleman had been persuaded to bore for coal into rocks below the coal formations. He cut down the trees on his estate to pay the expenses, under the influence of the Staffordshire miner who induced him to try for it, and who would occasionally bring up small pieces of coal in his pocket. It was of no use to tell him that he was below the coal, and that it could never be found there. He went on boring, and continues to do so to this day, for anything the lecturer knew to the contrary.

The association of beds of ironstone with coal was a most remarkable fact, and of the highest importance in a practical point of view, though it was by no means clear from whence the iron was derived, possibly from chalybiate waters or decomposed vegetation.

Besides the use of coal as a fuel, there was another great fact in connection with it, and that was the production of mineral oils in enormous quantities from the coal fields of North America. This discovery had proved of the highest value and utility and had developed a trade of its own.

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Mr. Brodie then discussed the probable duration of the coal supply in Great Britain. It would be worked out in time, as a matter of course, but it would be a very long time. He thought the alarmists had frightened them too much, and he would say at once, from the great extent of coal even in the South Wales coal field alone, which had not yet been touched, that there could be no doubt it would last for the next five hundred years at least, and his own conviction was, that it would last for a thousand years to come. There could be no fear of our children or grand-children, or great grand-children, suffering from the want of it. Nevertheless, that was no reason why it should be wasted. By all means let the enormous waste that now takes place be checked. If this were done the failure of supply was much too remote to concern us much. In consideration of the falling rain he would not detain them by entering into further details. Coal deserved to be esteemed as highly as any mineral the earth contained. It had been elaborated by God's providence in ages past for our present use. It was impossible to calculate the ages it had taken to give it stability, and no time, however great it might be, in his opinion could be rightly said to interfere with Holy Scripture. We ought all to be most thankful that the divine Creator had in his wisdom and goodness stored up the ancient vegetation of the world in the form of coal for the use of man and his own glory. (General applause).

NOTE.—Several new genera of Amphibian Labyrinthodont Reptiles have been lately discovered in the coal measures in Kilkenny, Ireland, and will shortly be described by Professor Huxley and Mr. E. P. Wright.

Immediately the address was over—and it was much shortened by a return of the shower—"by no means a *dry* lecture," as a gentleman observed—the President told them, that they had still an hour-and-a-half's time to wander through the walks and cross over the New Weir Ferry, which they saw before them, to the carriages which were to meet them there. They must not be at the ferry later than half-past 4 o'clock, for the dinner at Ross would be punctual. He took this opportunity also of telling them, that if the wishes of the committee were carried out a small bouquet would mark the place of every lady at the table, and every lady would find her own place indicated by the rose-coloured card she had given up on entering the boat.

All parties now separated to wander at their leisure in search of ferns or flowers, which some of them did with much enthusiasm, regardless of damp leaves, and testing the knowledge of the botanists with regard to all the plants they could find. One gentleman set off to look for the Royal fern (*Osmunda regalis*), and it really was a question some few years since whether it did not grow amongst the Coldwell rocks. One botanist found it there, and gladly carried off specimens of the treasure (for this fern does not grow wild in Herefordshire), and soon after this plant disappeared altogether. His friends began to hunt for it there also, and two years after another gentleman met

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with a fine specimen in a snug corner, which underwent the same process of spoliation and robbery outright. This spread wider still the news of the discovery, and when a third plant was found in a still more secluded place, the Coldwell rocks began to be considered what the botanists call a "habitat" for the *Osmunda*. It was of no use for others to hesitate, and say that "the *Osmunda* likes a wet, boggy situation," for the answer was ready at once, "Yes, but you often find bits of damp, boggy soil in rocky places," and besides, there was the undeniable evidence of the plants found. The true explanation came out some time after, in the accidental complaint of the owner of the property to one gentleman who had heard the botanical rumour. He was telling him that he had taken the trouble several times to plant the *Osmunda regalis* there, but it no sooner began to flourish than the plants were carried off wholesale!

The only rare plants actually gathered were the deadly nightshade (*Atropa belladonna*), a wanderer very possibly from the gardens of Tintern Abbey in the olden time, the blue flea-bane (*Eri-geron acris*), the sulphur-smelling Pepperwort (*Lepidium ruderale*) of which an old herbalist writes that it will drive all fleas from a chamber, and they will not return "by reason of breaking their limbs in jumping out of ye windows." The swine's cress (*Senebiera coronopus*), the hound's-tongue (*Cynoglossum officinale*), and many others of less interest, were also found.

The several parties appeared in due time at the ferry, had a pleasant drive of about seven miles to Ross, and arrived there in ample time.

The following gentlemen and ladies attended the meeting:—The President, Dr. Bull, with Miss Banbury and Master Bull; the Vice-Presidents, the Rev. H. Cooper Key and Dr. Mc Cullough; the Honorary Secretary, the Rev. Geo. H. Cornewall; the Rev. P. B. Brodie, vice-president of the Warwickshire Field Club; Arthur Armitage, Esq., and Mrs. Armitage, Dadnor; R. Hereford, Esq., Sufton, with Miss C. Hereford, the Rev. R. Hereford, and Mr. George Hereford; K. Manly Power, Esq., Hill Court, with two sons; James Rankin, Esq., Bryngwyn, Miss Bushell and Miss Ritchie; J. Stratford Collins, Esq., and Mr. S. Collins, Wythale; N. Kyrle Collins, Esq., and Mrs. Collins; the Rev. W. D. V. Duncombe, and Mrs. Duncombe, Mawfield; John Lambe, Esq., Mrs. Lambe, Mrs. G. H. Hanbury, Miss Price, and Miss Stokes, Hereford; H. H. Wood, Esq., and Miss Wood, Whitehouse; Dr. A. R. Smith, and Mrs. Smith, Hereford; the Rev. — Spittal, Mrs. Spittal, and Miss Jackson, Ewyias Harold; T. Nicholson, Esq., Mrs. Nicholson, and Miss Leggatt, Hereford; R. H. P. Styles, Esq., and Miss Styles, Hereford; Thomas Blashill, Esq., London; Edw. David, Esq., Fairwater; H. G. Apperley, Esq., Thomas Cam, Esq., H. Cribb, Esq., Timothy Curley, Esq., H. Scrivin, Esq., and F. Symonds, jun., Esq., Hereford; R. D. Harrison, Esq., and H. J. Jenkins, Esq., Holmer; the Rev. T. J. Eld, Worcester; the Rev. Arthur Gray, Orcop; the Rev. Michael Hopton, Hoarwithy; the Rev. W. H. Purchas, Lydney; the Rev. — Robinson; and the Rev. C. J.

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Westrop, Wormbridge; Messrs. Blashill, Hereford; Watkin Old, Monmouth; Alfred Purchas and Henry Southall, Ross; and the treasurer and assistant secretary, Mr. Arthur Thompson.

The gentlemen and ladies had scarcely had time to admire the view from the coffee-room windows when the dinner was announced. The tables were beautifully decorated, and, as had been arranged, a very elegant bouquet marked the place of each lady. A very handsome dessert ornamented the tables, and it is sufficient to say that the dinner itself was worthy of the occasion.

The PRESIDENT rose immediately after dinner, and said that it was his first pleasant duty, in the name of the Club, to thank those ladies who had done them the honour to attend the present meeting. They had shown such enthusiasm in the field that he began to think if there was not a gentlemen's field club there might perhaps be one for ladies. They were very glad to welcome them as "fair graduates in science" for the day (laughter). He must tell them, however, that the Woolhope Club did not always put on so festive an appearance. They generally did rather more work in the field and fared rather less well at the table. It was in honour of their presence that the handsome dessert before them had been sent. The fine Queen pine, the figs, and many other fruits, came from Whitfield, the Rev. Archer Clive; and Mr. George Clive, of Perrystone, had most kindly sent them a basket of fine grapes. Mr. Armitage had been most generous in sending for us grapes, apricots, melons, and other fruit. Mr. Hereford never fails to do what he can for the interest of the club, as the fruit he kindly brought with him testifies to-day. And many other of our members had also most readily met the wishes of the committee in this matter, and he was sure they would wish him to give the thanks of the club to all those gentlemen (applause). He would also take the opportunity to thank Mr. Alfred Purchas and Mr. Henry Southall for the kind way in which they had done everything in their power to help the committee in their arrangements (hear, hear). For the very elegant bouquets, which had been arranged so tastefully as to surprise himself very much and to gratify all the ladies present, they were indebted to Mrs. Southall and Mrs. Purchas, and he hoped their thanks would be conveyed to them. They had thus given a brilliant finish to all the other preparations. It was too late in the year for them to see many of the rare plants of the district they had visited that day, but Mr. Southall, at his request, had brought specimens of them for their examination, and he would now kindly read to them a paper on the subject.

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THE MORE RARE PLANTS OF THE DOWARD DISTRICT.

BY MR. HENRY SOUTHALL.

Since many of the most interesting plants in the district the club has visited to-day are now out of flower, I have been requested by our President (Dr. Bull) to bring those which are most curious or rare in a dried state for your inspection, and to give an account of the localities in which they grow. I should scarcely have undertaken to do so, however, if I had known that Mr. Purchas would have been here, since he is now preparing for publication the flora of Herefordshire, and knows so well this district. I propose to give the English names where I can, to make myself more intelligible to those who are not botanists; and I am only sorry that a study which has afforded me so much pleasure should not be more generally popular. Few but those who have taken it up can estimate the amount of additional interest it can give to a country walk, or a leisure hour.

I must now ask you to accompany me to the Great Doward in the latter end of January or beginning of February, and then, if the season is not a severe one, we shall find in a little hollow under a tree, not far from the river, and just at the base of the slope, a good-sized patch of the bear's foot, or green hellebore *(Helleborus viridis)*, with its large green flowers and finger-shaped leaves; and not far from it, in the coppice above, an occasional plant or two of the other British species, the setter wort *(Helleborus fœtidus)*, a more shrubby and fœtid plant than the former. Both these plants belong to the same genus as the Christmas rose *(H. niger)*. They are extremely local, and are notable for their medicinal virtues.

Climbing the rocks, we come to a little projecting ledge overlooking the river from a considerable elevation, and here several rare plants cluster together. The carex or sedge tribe is represented by three very rare species —*Carex clandestina*, *C. montana*, and *C. digitata*. Here, too, later in the season, the pretty dropwort *(Spirea filipendula)* raises its pink buds and white blossoms; while enclosing this small space are the wild service tree *(Pyrus torminalis)* and the white-beam (*Pyrus aria*), remarkable for its leaves being so white and downy beneath.

Two or three varieties of the lime (*Tilia*) were also noticed by Mr. Babington as growing in these woods. The hairy violet (*Viola hirta*), the horse-shoe vetch (*Hippocrepis comosa*), the lesser burnet (*Poterium sanguisorba*), and many others are there; and on the other side of the path, later in the summer, may be found the great white helleborine

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(*Cephalanthera grandiflora*), an interesting plant, and not to be found elsewhere in this county. Amongst the roots of the beech trees, but not parasitical upon them, the yellow bird's nest (*Monotropa Hypopitys*) grows.

Pursuing the path through the wood in a bog on the top of a tufaceous rock may be found *Carex Pendula* with its gracefully drooping spikes, the small valerian (*Valeriana dioica*), the great reed (*Phragmites communis*), and further on the shepherd's staff, or small teasel (*Dipsacus pilosus*). Ascending again close to the deer park fence, you may meet with a stray plant of the spurge laurel (*Daphne laureola*), but it is so much sought for by waggoners for their horses, that it is difficult to find. On a castellated rock forming the summit of the Little Doward, where it overhangs Martin's Pool, growing on little ledges where there is scarcely any soil, and only about two or three inches high, may be seen in February the rock Hutchinsia (*Hutchinsia petræa*), with its small white flowers. This is considered a very rare plant, though perhaps sometimes overlooked from its small size. On the same rocks may also be found the hairy wall cress (*Arabis hirsuta*). We have however not yet succeeded in finding the *Arabis stricta* which is now nearly the only plant wanting to complete the list of those found on St. Vincent's rocks at Bristol. *Poterium muricatum* also grows there, and lower down may be gathered plentifully the deadly nightshade (*Atropa Belladonna*) with its lurid purple flowers and violet black berries. These are highly poisonous, and often have proved fatal to children. The wild lettuce (*Lactuca virosa*), the columbine (*Aquilegia vulgaris*), three uncommon grasses, viz., *Hordeum sylvaticum*, *Melica nutans*, and *Bromus erectus*, are frequent, and on the other side of the river *Brachypodium pinnatum*. On many of the projecting and unshaded points covering the *débris* you will notice beds of the *Geranium sanguineum* with its large brilliant crimson petals, intermingled with the yellow rock rose (*Helianthemum vulgare*), having often a very beautiful effect. In the woods across the river grows the lily of the valley (*Convallaria majalis*), and also the elecampane (*Inula Helenium*), one of our finest British plants, with blossoms like sunflowers and leaves nearly two feet long. The lady's finger (*Anthyllis vulneraria*), the madder (*Rubia Peregrina*), toothwort (*Lathrea squamaria*), here, parasitical on the roots of the hazel; the lesser periwinkle (*Vinca minor*), *Ranunculus parviflorus*, together with the bee, fly, butterfly, and bird's nest orchis, all which curious or rare plants are to be found near the top of Symonds Yat. *Cephalanthera ensifolia* another orchid, and all the St. John's worts (*Hypericum*) except two, grow near. The fennel (*Fœniculum vulgare*) appears to be naturalized in several places, and in an out-of-the-way spot, under the Coldwell rocks, is one of the very few localities in England for the wood hound's tongue (*Cynoglossum sylvaticum*). Most of the common species of ferns are abundant, but the limestone polypody (*Polypodium calcareum*), sometimes called the Derbyshire fern, grows in great luxuriance and profusion. The scaly hart's tongue (*Ceterach officinarum*) grows there, but not so plenti-

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fully, and the adder's tongue (*Ophioglossum vulgatum*). The brittle fern (*Cistopteris fragilis*) formerly frequent on the walls, is now nearly extinct. The neighbourhood of Ross also furnishes the following amongst many more: the yellow star of Bethlehem (*Gagea lutea*); *Narcissuss biflorus*, butter wort (*Pinguicula vulgaris*); alkanet (*Anchusa sempervirens*); the blue pimpernel (*Anagallis cerulea*); herb true love (*Paris quadrifolia*); the lesser winter green (*Pyrola minor*); monkshood (*Aconitum napellus*), apparently wild; henbane (*Hyoscyamas niger*); also Conium, Digitalis, and Colchicum, very abundantly, so that we have a long list of highly poisonous plants. Three rare plants have lately been found here, viz., *Bunium bulbocastanum*, *Potamogeton gramineus*, and *Sparganium minimum*—neither of these was before known to grow in this county. The woods near contain five species of wood rush (*Luzula Forsteri*, *Borreri*, *Pilosa*, *Campestris*, and *Sylvatica*). The arrow head, flowering rush, and the purple and yellow loose strife, grow on the banks of the Wye and in its waters; the American water weed (*Anacharis alsinastrum*) is rapidly increasing. We have also the Deptford pink (*Dianthus armeria*), *geranium phœum* the three beautiful campanulas (*Rapunculus*, *Patula*, and *Latifolia*), the mother wort (*Leonurus cardiacea*), held almost sacred by the villagers, &c., &c. I may also mention the *Lolium temulentum*, supposed to be the only poisonous grass, and known in very early times as "drunken darnel," from the intoxicating effects it produced, is happily now very scarce. The interesting question as to the geographical distribution of plants, and how or why some are thus scattered in solitary groups about the land, whilst others are almost universally abundant, I must leave to wiser heads. I trust I have shown, at any rate, that we have in this beautiful neighbourhood, a very fertile field for patient and diligent search.

Mr. Southall's paper was illustrated by beautifully prepared specimens of the several plants which were arranged upon the side of the room. He had also brought several duplicates for presentation to the botanical members; and what was still more thoughtful and considerate, he had brought a whole basket full, some dozens, of the roots of the limestone polypody (*Polypodium calcareum*) from the Coldwell rocks, each nicely packed up in damp paper for carrying away—and carried away they soon were, every one of them, with very great satisfaction.

The PRESIDENT then called on Mr. Brodie for his paper on the "Insect and Saurian beds of the lias formation."

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A SKETCH OF THE LIAS GENERALLY IN ENGLAND, AND OF THE INSECT AND SAURIAN BEDS, ESPECIALLY IN THE LOWER DIVISION.

By the Rev. P. B. BRODIE, M.A., F.G.S., Vice-President of the Warwickshire Naturalist's Field Club.

There are many points of local and general interest in the history of the Lias, both from its wide extent and its abundant and remarkable fossils. Taken as a whole, there is no formation which presents a greater uniformity of lithological character, so that certain zones in it can be thus as readily distinguished by the practised eye as by their zoological contents, and this especially holds good with regard to the lower portion, which it is proposed more particularly to describe in this paper. Of course, as in every other case, there are local exceptions to this rule, but they are probably less so in the Lias than in any other deposit of equal thickness and importance. A glance at the geological map will show you that its course may be traced from the coast at Lyme in Dorset on the S.W. to Whitby in Yorkshire on the N.E. In the midland counties it is much more expanded, bounded on the west by the New Red Sandstone and on the east by the Oolites, both of which great formations run parallel with it in its range. In Gloucestershire and Somersetshire it sends off many spurs to the N.W., and probably from the effects of extensive denudation from Bristol to Taunton, exhibits many irregularities and numerous outliers, some of which, as in Gloucestershire, Warwickshire, North Staffordshire, and Cumberland, are of special interest, and present some remarkable features, well deserving, especially in the two last-named counties, of careful examination.

In order that you may better understand the history of the lower division of the Lias, it will be necessary briefly to describe the entire formation, but I propose, as requested, to dwell more at length on the inferior division so largely developed in Warwickshire, Leicestershire, Gloucestershire, and Somersetshire. This formation has been thus separated into three subdivisions, viz., the upper, middle, and lower Lias. Such divisions are useful to a certain extent, but may ultimately have to be changed or modified according to future discoveries; for though many of the organic remains are peculiar not only to these divisions, but some even limited to certain zones, others are common to the whole; and even the Ammonites, about which so much stress has been laid as marking special zones, may be very possibly found to have a much wider range, and some species indeed which were supposed to characterise particular beds have been since discovered both above and below that zoological horizon. Whatever the ammonites may be, it is certain

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that the Mollusks and the Gasteropods are not specially limited in their range, many of the former certainly recurring again upwards and downwards throughout the entire formation. Further on it will be seen that the same holds good even more remarkably with regard to the Fish and Saurians. The upper Lias in Somersetshire and Gloucestershire consists for the most part of beds of blue and dark shales, with a subordinate band of limestone towards the lower part. In Yorkshire it presents a somewhat different character, and becomes of considerable economic importance from the abundance of sulphate of alumina with which the upper shales are charged, all of which contain iron. The top shale is underlaid by a cement stone bed, and the lower by a bed of jet 30 feet thick. The shales in Gloucestershire and Somerset may contain alum, but I never observed any jet rock or cement stones, and they are of no commercial value, and are only worked for the sake of the marlstone below. The upper Lias is very irregular in its distribution, and, as in Warwickshire, it is often reduced in bulk, and in some cases it is entirely wanting. When it reaches its maximum development it attains a thickness of 200 feet (to 230 feet in Dorset) and upwards. Fossils are generally abundant; the clays and shales being full of Ammonites, *leda*, *rostellaria*, and other marine shells, and remains of Fish and Saurians. The chief depository of the fossils is, however, the subordinate limestone, which, from the frequent occurrence of fish in Gloucestershire and Somersetshire, has been termed the fish bed. A small species of *leptolepis* occurs in it not unfrequently in both these counties, and, besides the larger *pachycormus* and *lepidotus* associated with it, are some well-preserved Sepia, Crustacea, and Insects, consisting chiefly of *Neuroptera* and *Coleoptera*. It was from this stratum that I obtained an entire dragon fly, with wings expanded as if in flight, the finest specimen in my collection. As a rule, however, the insect relics are not so numerous as in the lower Lias. The limestone containing them is nodular in places, and from one of these I obtained a large and entire specimen of *lepidotus*. From similar nodules at Ilminster, in Somersetshire, my friend, Mr. C. Moore, procured his fine series of fossil fish in a wonderful state of preservation, and one or two perfect *teleosauri*. This fish bed is known to occur in Somerset, Dorset, Gloucester, and Northampton, so that it has an extensive range.

Immediately underlying the upper Lias shales is the Marlstone, the top of the middle lias, a very hard stone of a blue and brown colour, much used for road material, walls, and building purposes, for which in some counties, as at Banbury, in Oxfordshire, it is largely and profitably employed.

In this part of the series there is a valuable deposit of iron ore, formerly worked, near Gloucester, and now worked in Oxfordshire, and more extensively in the vale of Cleavland, in Yorkshire. In Gloucestershire, Lincolnshire, and Yorkshire, it occupies high ranges of hills, and here and there forms outliers, often capped by a thin stratum of upper Lias. In Northamptonshire, however, it occurs at a much lower level, the higher ground being

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exclusively composed of the great and inferior Oolite. It generally abounds in fossils, the cephalopoda being especially numerous, with a great variety of large *pectens*, *pinna*, and other marine shells, and in places several species of star fish and *Ophiura* have been met with, both in the ironstone and in the dark clays and shales which underlie the marlstone. Some of these inferior sandy beds abound in fossils. This portion of the Lias at Shipston, in Warwickshire, contains in abundance a fine species of coral, *montlivaltia cuneata*, the largest known in our Lias, except the *isastrea Murchisoni*. Although not noticed, yet below this horizon it occurs in the infra Liassic strata at Saint Cassian, in the Alps, and therefore must have a wide range. In Gloucestershire the marlstone and associated beds attain a thickness of 116 feet. The underlying Ochraceous Lias,* rarely exposed, is full of yellow ferruginous nodules, 4 feet, containing *belemnites elongatus*, *trochus imbricatus*, *cardinia attenuata*, *spirifer punctatus* and *rostratus*, *arca Buckmani*, *mytilus hippocampus*, &c. Below this, and forming the top of the lower Lias, in Gloucestershire and elsewhere, are masses of dark-coloured calcareo argillaceous and finely laminated clays and shales, which may be divided into separate beds, each of which is characterised by some peculiar fossils.

Laminated Lias.—This is the uppermost clay bed of the lower Lias shale, about 10 feet thick. It contains *ammonites Conybeari*, *Henleyi*, *perni ventricosa*, *pentacrinites*, *ophioderma*, *Brodiei*, *arca truncata*, *gryphœa cymbium*, &c. These are succeeded by thick clays, respectively termed the belemnite and ammonite beds; the first 12 feet and the second 3 feet thick, abounding in the genera named; *ammonites elegans*, *Turneri*, *Smithii*, and *planicostatus*, and others, characterising the latter. As this stratum is of a yellow colour, from the prevalence of iron, it can lithologically be easily distinguished from the argillaceous stratum succeeding it, ten feet or more in thickness, named the *hippopodium* bed, from a remarkable bivalve shell which abounds in it, and also yields a variety of other testacea, viz., *gryphœa incurva* and *obliquata*, *terebratula numismalis*, *rhynchonella*, and two small corals, a species of *montlivaltia*, and *thecocyathus rugosus*, which are also frequently met with at Fenny Compton and Honeybourne, in Warwickshire, in the same bed. Another and inferior argillaceous band is characterised by *cardinia Listeri*. These sub-divisions were adopted by my friend, Professor Buckman, in his work on the geology of Cheltenham, published in 1845, and may hold good to a certain extent in other equivalent portions of the Lias in other counties; but, as I said before, further discoveries may lead to a considerable modification of these sub-divisions founded upon special fossils, which may, as I believe, ultimately be found to have a much more extensive vertical range. Very few fish occur in this part of the lower Lias in Gloucestershire and Warwickshire,

* I have classed the ochraceous or yellow Lias with the marlstone, to which it evidently more properly belongs. In Yorkshire the marlstone and ironstone series are about 160 feet thick. The entire thickness of the whole of the Lias in Gloucestershire is probably not much less than 1,000 feet. At Bridport, in Dorset, the middle Lias amounts to a thickness of 250 feet, and the upper Lias 230 feet.

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but at Lyme, in Dorsetshire, they abound, and range from the middle to the lower inclusive, and the same may be said of the *saurians*, which are not limited there to the *insect* and *saurian* beds, still lower in the series, though they are for the most part in Gloucestershire, Warwickshire, and Leicestershire. In many places these clays are extensively used for brick making, for though they contain concretions here and there, there are no bands of solid limestone amongst them. Below them, however, thick and valuable beds of limestone largely prevail, and are often quarried for lime, walls, and roads; they make a very bad material for this latter purpose. The uppermost of this more calcareous portion of the Lias has received the designation of "Lima beds," from the abundance of a large *lima*, the *l. gigantea*, which has a very wide horizontal range, for in various parts of England, where I have examined this division of the Lias, I have always met with specimens of this fine shell. The two finest inland sections of this division with which I am acquainted are at Frethern Cliff, in Gloucestershire, and Saltford, on the Great Western Railway between Bath and Bristol, and on the same line at Harbury, near Leamington, in Warwickshire, and at my friends', Messrs. Greaves and Kirshaw's pits at Harbury and Stockton, a few miles distant, where the limestones, as at Wilmcote, still lower in the series, are used for making hydraulic cement. The railway cutting at Harbury presents the following section, in descending order:—Six beds of limestone, the uppermost white and rubbly, divided by clay containing *lima gigantea* and other shells; black shale, 2 ft.; limestone, full of *rhynchonella variabilis*, 1 ft.; dark shale, 2 ft.; blue limestone, fucoid bed; ten beds of limestone, divided by shale seen in succession; shale, 3 ft.; thick band of hard blue limestone, one of the thickest in the section, not exceeding 2 ft.; irregular masses of limestone in shale 4 ft.; five beds of limestone in regular layers, divided by a thick stratum of dark shale. Unfortunately the rest of the section is covered up by debris, so that the strata cannot be observed down to the white Lias, which appears at the north-western end of the cutting and rises gradually in that direction, and is quarried at many places in the neighbourhood. With the exception of the uppermost layers of limestone, all the rest are, as usual, of a blue colour, varying in thickness from a few inches to two feet. The entire thickness which could be measured *en masse* is from 30 to 40 feet, but if the shale now concealed could be added it would much exceed this. If the Insect and Saurian beds are represented in this section, they are but very feebly developed. It is not always easy to correlate *distant* sections, even in the same zone, with each other, because some beds thin out and others come in, but even where the relative thickness varies, the lithological character and zoological contents of the "Lima beds" generally throughout England are very similar, and may thus be readily identified. At Saltford, according to my friend Mr. Sanders, they attain a thickness of 54 feet, and at Lyme my friend Dr. Wright states them to be 35 feet 4 inches. At the former place the strata which intervene between them and the white Lias would seem to be

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thicker than at Harbury, but in both cases the latter is seen passing into the "Rhœtic beds," which are more fully developed at Saltford than at Harbury. Fossils are usually abundant in this part of the series, especially *ammonites* of great size, a *Bucklandi* and *Conybeari*, *nautilus striatus*, a large *pinna*, *gryphœa incurva* and *arcuata*, *ostrea irregularis*, *cardinia ovalis*, *modiola*, *rhynchonella variabilis*, *waldheimia perforata*, *cidaris Edwnrdsii*, *extracrinus briareus*, *lima gigantea*, and *antiquata*. Fish and Saurian remains are very rare in Gloucestershire and Warwickshire, but are met with occasionally elsewhere. There is also one bed of limestone and shale charged with masses of fucoids, which holds a similar position in both these counties. In Warwickshire, Worcestershire, and Somersetshire, a species of *isastrea* is now and then met with, and this is undoubtedly the true position of this coral; but there is another in the Lias at Skye, in Scotland, which occupies a different and probably lower position, which may, perhaps, belong to the same species *(isastrea Murchisoni)*. It occurs there in a regular bed, in masses three feet thick. I have also discovered a small *cladophyllia* in the vale of Gloucester. I allude particularly to the Corals, because until within the last few years they were thought to be, with one or two rare exceptions, almost entirely wanting in the British Lias, but now many genera and a still larger number of species are known, and if certain forms mark particular beds this class of Zoophytes holds nearly as important a place as the Ammonites, except, of course, that the latter are much more abundant. Nor must I omit to mention the presence of Insects, chiefly consisting of *elytra* of beetles, which I discovered both in the shales and limestones of this series in the vale of Gloucester, but with the exception of the upper Lias, the calcareous lands which more immediately overlie the "Rhœtic beds," are the chief repository of the *Annulosa*. As they are comparatively rare in the "Lima beds," they were probably a few remains of beetles drifted far out to sea, and deposited with the marine fauna of the period. With the exception of pieces of wood, fragments of *Araucaria*, and single fronds of ferns, these are nearly all the evidences we have of the contemporary terrestrial flora—a scanty record, indeed; but on which no one, of course, would infer that there might not have been an abundance of animals and plants on some far distant land, the cliffs of which were washed by the waves of the Liassic sea.

The series of strata which succeed in descending order, those last-mentioned, consist of courses of limestone and shale mostly of a grey and blue colour, but of much finer texture than the above. Their icthyological character is so distinct that they can readily be distinguished from the "Lima beds," and it is worthy of note that they retain this peculiarity over a wide area in various parts of the country where I have studied them. The limestones are usually very finely laminated and less crystalline, and contain in greater or less abundance a number of insect remains by which they may be very well marked, and hence I have denominated them "Insect Lime-

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stone," though Dr. Wright has ignored this, and applied the term Saurian beds to them. In the first place the former are more numerous than the latter, and as yet, with the exception of the few referred to in the Lima zone, have not been observed in our Lias between the lowest limestones and the upper Lias, and they hold a higher rank in the animal kingdom; and though more frequent in some layers and places than others, after breaking up a few blocks of stone some small wings or *elytra* are almost sure to be found. They are also of special interest and importance, as being almost the only relics of creatures inhabiting the land, while the marine fauna is never absolutely wanting. As Mr. Dawkins and Mr. Moore have discovered teeth of mammalia in the Rhætic series of the Trias beds, it is fair perhaps to conclude if we may venture to speculate so far, that the insect tribes were not the only denizens of the land during the Liassic epoch, and some future fortunate geologist may discover many other forms of contemporary animal life. I have traced these insect limestones in Somersetshire, Gloucestershire, Warwickshire, and Leicestershire, where they present the same mineralogical characters, and contain similar fossils. In some places one or two layers of limestone only are present, in others five or six or more, and they seem to be best developed in the two latter counties. Insects occur in all, more rarely perhaps in Leicestershire, where, as I had previously predicted, they have been lately discovered. Similar beds, I believe, occur in Nottinghamshire, and my friend Mr. Norwood has detected them with insect remains near Hotham, in Yorkshire, so that they maintain their persistency both lithologically and zoologically over a wide horizontal area. The following sections at Wilmcote and Binton, in Warwickshire, will explain the nature of this division of the lower lias:—

		FT.	IN.	IN DESCENDING ORDER. REMARKS.
Lias	1. Yellow clay	2	0	
	2. Light-coloured limestone	0	9	Wilmcote Section.
	3. Dark laminated limestone	1	8	The term grey for the 7
	4. Light-coloured limestone	0	8	limestones (6 to 18 in-
	5. Dark, finely laminated shales	1	6	clusive) is not strictly correct: they are some-
	6. Grey limestone	0	4	times grey and white
	7. Dark shale, like No. 5	1	0	externally, but often
	8. Grey limestone	0	4	blue in the centre,
	9. Dark shale	1	0	speckled with dark
	10. Grey limestone	0	4	spots, and most of them
	11. Dark shale	1	0	readily splitting along
	12. Grey limestone	0	4	the line of bedding.
Insect beds.	13. Dark laminated clay	0	8	Fish and saurians and
	14. Grey limestone, of irregular thickness	0	2	ammonites occur more or less throughout. The
	15. Clay, like 13	0	9	insect remain are con-
	16. Grey limestone	0	5	fined to the limestones,
	17. Clay, like 13	0	7	and notably to the
	18. Grey limestone	0	3	lowest, where they are
	19. Clay, like 13	4	2	most numerous.
	20. Fragmentary shelly bed	0	3	Saurians especially abun-
	21. Dark hard strong clay	0	7	dant in Nos. 21 to 30
	22. Dark blue limestone and clay	0	9	inclusive.
Lower Lias.	23. Clay, like 13	1	0	In these shales and lime- stones beyond Brocke- ridge Common, near Tewkesbury, some fine fern fronds have been obtained, and are now in the Worcester Mu- seum.

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IN DESCENDING ORDER.

		FT.	IN.	REMARKS.
Lias.	24. Dark grey limestone	0	4½	Ostrea liassica and Modiola minima.
	25. Hard crystal		1	Firestones, in three bands.
	26. Line limestone.....		2	
	27. Ditto		3	Bottom of the quarry.
	28. Hard, dark slaty shale ..	1	0	The strata below 27 were ascertained by means of a shaft.
	29. Hard, shelly limestone..	0	1	"Guinea bed," so called from its ringing sound when struck.
	30. Green, clunch clay	0	3	
	(Bottom of the Lias.)			(22 ft. 8 in. Lias.)
Rhætic Series.	31. Fine grained green marl..	0	3	Estheria bed.
	32. Black shale	12	6	
	33. Laminated micaceous shale	1	0	
	34. Laminated shale	0	6	
	35. Ditto	1	6	"Upper Pullastra" bed, "avicula contorta," "Pullastra arenicola," and "Cardium."
	36. Dark shale	2	6	
	37. Dark clay	0	6	
	38. Laminated clay with septaria	1	3	"Pecten Valoniensis."
	39. Clay with shells	1	8	
	40. Black, hard, laminated clay	4	0	
	41. Pyritic stone with shells,	0	1	"Lower Pullastra" bed.
	42. Dark clunch clay	0	8	
	43. Soft brown clay			
	Total	48	10	

Dip 2½ degrees north of east.

OSBORN'S PIT, BINTON.

	FT.	IN.	REMARKS.
1. Clay.....	7	6	
2. Whitestone	0	7	
3. Clay.....	8	0	
4. Liveries	0	4	
5. Clay, with masses called mawns or dumplings....	1	0	
6. Bottom liveries.....	0	2½	
7. Clay, with paving rock often wanting	1	8	No fossils.
8. Quarters, sometimes wanting	0	3½	
9. Clay, with thin layer of stones occasionally.....	1	2	Insects.
10. Thin paving rock, constant	0	3	
11. Clay	0	9	
12. Bottom limestone	0	4½	Abounding in insects.
13. Clay, with crystalline stony layers	3	10	
14. Coprolitic, pyritic red	0	2	Full of broken shells, teeth, and bones of Saurians, pyritic ammonites, which do not occur lower, Lima.
15. Hard blue stone	0	4	
16. Brown crystalline rock	0	4	
17. Rock	1	0	Otopteris acuminata and obtusa.
18. Clay.....	1	0	
19. Firestone	1	0	Firestones, with Cardinia and Corbulæ.
20. Rock	0	2	
21. Clay	0	3	
22. Bottom blue stone	0	2	No fossils.
23. Clay.....	0	3	

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	FT	IN.	IN DESCENDING ORDER. REMARKS.
24. Very hard rock	1	0	Guineas. A very remarkable bed, here and there like Forest marble. Masses of fossils on the surface. Saurians, fish scales, gresslya, avicula cygnipes, cardinia, hemipedina Tomesii, bryozoa, casts of plants like reeds or grasses, corals.
Total	26	6	
25. Yellow clay.			
26. Clay, with white, stony nodules			Masses of estheria.
27. Dark clay.			

These sections were drawn up by my friends Messrs. Kirshaw and Tomes, and quoted also by Dr. Wright in his memoir in the Palæontographical; but I have not strictly adhered to the remarks on the fossils by the latter, but have made such alterations and additions as I considered necessary. I need not quote here my own published sections on the same strata at Bidford and Temple Grafton, S. W. and N. W. of Binton, because they tally for the most part with the one at Wilmcote, and the latter has the advantage of giving the entire thickness of the lower Lias, and proving the fact of its being immediately succeeded by the Rhœtic beds; for although my lamented friend, Hugh Strickland, long ago discovered the Bone bed near Binton, and I have since found its representative still more to the north, the absolute sequence of the beds in due order beneath the lowest stratum of lias was not clearly made out, until a shaft was sunk for this special object. As a general rule, these basement beds pass into the Rhœtic zone, and are well exhibited at Wanclode cliff, Westbury, and Aust, on the Severn, in Gloucestershire. The higher ground round Wilmcote and Binton is capped by the "Lima beds," so that if an entire section was exposed we should have a tolerably complete representation of the more calcareous portions of the lower Lias down to the red marl. The district is more or less affected by small and often local faults, and one curious change in contiguous strata is worthy of note in one of the most westerly sections at Wilmcote. All the insect beds thin out and scarcely amount to three layers, the top band being irregular and shattered; a thick mass of shale succeeds, undivided, as elsewhere, by limestones, and below are three beds of limestone, viz., the firestone, with *Ostrea liassica*, but of a very different character. The limestones are of much economical value, being largely employed for flooring, paving, gravestones, and walls, and making hydraulic cement at Messrs. Greaves and Kirshaw's quarries, at Wilmcote. They make good paving stones, many of the slabs raised being of large size, but they do not weather well when used for gravestones. Some of them might be profitably used for lithographic purposes, and with this view I sent up some specimens to the Exhibition in 1851. With the exception of the Insects and fragments of plants, the fossils are entirely marine, two species of *ammonites*, a *planorbis*, and a *Johnsoni* being abundant and characteristic, and occur both in the shales and the limestones, but not many other shells.

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A species of *Astucus* and an *Eryon* (E. Barrovensis) of great size are not unfrequently met with in the insect beds; the largest I have seen in my collection measures 6 inches long and 2½ broad, and is in a remarkably fine state of preservation. They occur in the same zone at Barrow, in Leicestershire, and in Gloucestershire, Worcestershire, and Somerset, but not generally so large as in Warwickshire. In Gloucestershire and Worcestershire fish are not common, but more so in Warwickshire, and seem to be most frequent in Leicestershire, where a much larger number of genera are known. Dapedius is the most abundant, especially at Barrow, where fine specimens are found. A remarkably perfect *tetragonolepis* from Wilmcote is in the Warwick museum, and the small fish, *pholidophorus Stricklandi*. The large Enaliosaurians are well represented by some fine specimens of *ichthyosaurus* and *Plesiosaurus* –the *p. megacephalus* in the Warwick museum being nearly entire, and measuring 14 feet or more in length. It is stated to have been found in No. 21 of the Wilmcote section; but, as before observed, the great sea monsters of that date are not restricted to that bed, but prevail more or less in all, from Nos. 2 to 30. The remains of plants, though small and fragmentary, are of considerable interest in association with the insects, because together they afford the only evidence of the inhabitants of of the land. There are traces of *confervæ* and *musci*, *equisetaceæ (equisetum Brodiei, Buckmani, Liassium, Heerii*, &c.), and *filices (otopteris obtusa* and *acuminata) pinaceæ (cupressus, thuytes*, and *araucaria) hæloragеæ (hippurites)*, seed vessels of *umbelliferæ*, and a small net-veined leaf of *ericaceæ*, and though the four last named natural orders are all dicotyledonous, the latter is of special interest on this account from the great rarity of dicotyledonous leaves in so old a formation as the Lias. The plant remains were determined by my friend Professor Buckman* from specimens in my cabinet, and I have many others since then. In the Warwick museum there is a large mass of wood, with an attached branch, which I found in one of the insect beds at Temple Grafton. Comparing this list with the few recorded higher up, though meagre enough, it will give us a much better insight into the nature of the extinct Liassic flora than any other part of this series. Time will not allow me to dwell at any great length on the insects, a detailed account of which, with accompanying plates, will be be found in my work† on fossil insects, and since that was published, now 21 years ago, many important additions, as might be expected, have been made. Twenty-four families and genera had then been determined from the Lias. The *Coleoptera* and *Neuroptera* are the most numerous. Small beetles are not unfrequently found entire, and a few of large size; single *elytra* are most prevalent, several being occasionally noticed on one small slab. Among these may be noted the *buprestidæ*, *elateridæ*, *carabidæ*, *chrysomelidæ*, *telephoridæ*, *harpalidæ*, *carabidæ*, *gyrinus*, and *laccophilus*. Among the few *orthoptera* are *gryllus Bucklandi*, legs of *gryllidæ*, and *tegmina* of *blattidæ*, and among

* *Quarterly Journal Geological Society*. 1850.

† Copies may be obtained from the author, Rowington Vicarage, near Warwick.

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the *hemiptera* and *homoptera* are *cicada Murchisoni*, large homopterous insect, and one of the *cimicidæ*. Among the *neuroptera* we have *libellula Brodiei* and wings of other species often of great size; *orthophlebia communis*, a common and characteristic species, and met with also in the purbecks, *ashua liassina*, *chauliodes*, wings frequent, *ephemera* wings not uncommon; among the diptera, *asilus iynotus*, and some entire small dipterous insects. Many of the *libellulidæ*, were evidently of gigantic proportions, but most of the insects were of small size, and like the associated plants indicate a temperate climate, and are more nearly allied to forms which now inhabit North America. There are few extinct or unknown genera among them, so different from the marine fauna associated with them. Aquatic or sub-aquatic forms prevailed to a considerable extent. Some of the *coleoptera* were scylophagous or herbivorous, others aquatic, some were omnivorous, and many predaceous, consequently the land must have contained plants suitable to their food, and *insectivorous* animals to devour them in their turn. Though the Saurians and Mollusks indicate a warm climate, there is no proof of any ultra tropical heat, and if we suppose the insects, which (excepting the gigantic *libellulidæ* and larger *chauliodes)* belonged to temperate zones, to have inhabited the higher regions of a tropical country, such as the Himalayas and the Andes, and to have been carried by streams into the ocean at greater or less distances from land, according to circumstances, the apparent anomaly is accounted for and seems the most probable inference.* Considering the vast numbers of the insect tribes of the present day, the number hitherto recognised in a fossil state is comparatively small, but additions are constantly being made, and in time we may have a closer approximation to the actual proportions of the *annalosa* living at the period. With the scanty record which the Lias affords of terrestrial life, the insects thus described are by no means to be despised and form a really important addition to the history of that formation.

A few words must be said in conclusion on certain limestones which in Warwickshire and Somersetshire succeed the insect and saurian beds. Their true position is undoubtedly beneath the latter, and they are known in both these counties by the name of the White Lias. Some geologists consider them to belong to the Rhœtic series, others to be passage beds between the Lias and the latter, while some still class them with the Lias. As they contain some fossils which are purely Liassic, and others which are entirely Rhœtic, it seems most probable that they are intermediate between the two, and should future investigations lead to the preponderance of Liassic forms over the Rhœtic they would then have to be definitely classed with the former, or with the latter if the reverse. They occupy a considerable area in the counties of Somerset and Warwick, where they are extensively used for making lime, and being often close-grained and hard, make a useful material for building. The colour of the limestones is mostly white, and occasionally

* Professor Heer found insect remains in the lower Lias of the Alps, but I am not able to state the exact position in which they occur.

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pink and grey. They are largely quarried near Rugby, where they contain a great abundance of iron, and present a singular eroded and uneven surface. I have never seen any true white Lias in Gloucestershire, though I am inclined to agree with those geologists who consider that the landscape stone or Cotham marble is its equivalent; but I do not agree with Mr. Etheridge in believing the insect bed with *avicula decussata* at Westbury, to be the representative in part, of the white Lias. As yet, no Saurians or ammonites are known in it, and the shells which are exclusively marine are not numerous. There are a considerable number of small corals, amongst which a species of *montlivaltia* is common both in Warwick and Somerset. Until quite lately the Lias terminated with the Red Marls, but now all the strata intervening between the white Lias and the latter will come within the Rhætic series of the Trias. They will not therefore come within the province of this paper, but I may just add that in the "landscape stone," or estheria bed at Aust Cliff, in Gloucestershire, some unusually well preserved remains of insects have been discovered, but they seem to be local, for I never heard of their occurrence in the same position elsewhere. Enough has, I trust, been said to show the importance and interest which attaches to this great and extensive formation, and if it contains less striking evidence of a terrestial fauna and flora than the Stonesfield's Slate, the Wealden, the Purbecks, or still later Tertiary deposits, it affords us a varied and remarkable history of the inhabitants of the sea during a most extensive epoch of the ancient world The singular flying reptile, the *pterodactyle*, now appeared for the first time, and the great Enaliosaurians were among the most formidable and predacious monsters of the deep. Associated with them, in seas of varying depth, were gigantic *cephalopods* and graceful *pentacrinites* and numerous tribes of fish. Wherever the land was we know it was not untenanted, and though we only have altogether, perhaps, a partial record of the past, it must ever be full of interest and instruction to the scientific inquirer.

The President then gave the thanks of the Club to Mr. Brodie for his kindness in coming to give them the benefit of his researches—for the interesting lecture on Coal he had given them in the field, and for the learned paper he had just read to them. The Club were much indebted to him, and hoped it was not the last time they should welcome his presence amongst them (applause).

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INSTRUMENT FOR ASCERTAINING THE EXACT HEIGHT OF TREES AND OTHER OBJECTS.

BY MR. S. WELLS, HOLME LACEY.

The PRESIDENT then said that he had now to bring before them Mr. Wells' "Instrument for ascertaining the exact height of trees and other objects." It was a great pleasure to him to have to exhibit anything so clever, for he believed it to be as original as it was simple and accurate. He did so nevertheless as a duty, for he should not have chosen himself to bring forward a subject which requires so much mathematical knowledge to do it proper justice. He hoped, however, they would not misunderstand him, nor imagine for an instant that he was not quite up to practical trigonometry (a laugh)—it would not do for the President of so scientific a club to admit that (laughter)—and therefore if any of the learned mathematicians who were listening to him should observe that he did not use the ordinary terms or formulæ of the schools in his explanations, they must be good enough to remember how necessary it was now-a-days to popularize these things (great laughter).

They were aware that the Woolhope Club was desirous of drawing up an account of the more remarkable trees of Herefordshire, and it was important to note their exact height. Whilst making inquiries on this subject, he had heard of Mr. Wells' instrument, and, on examination, was so convinced of its merits that he used every effort to induce Mr. Wells himself to exhibit it, but he could not prevail upon him to do so, and was therefore compelled, with his sanction, to bring it forward himself.

There were many ways of ascertaining the height of a tree, and before he attempted to describe Mr. Wells' instrument he would just glance at some of the other methods of doing so.

The first he might call the *guessing plan* Every third person you met believed himself capable of giving a close estimate of the height of any given tree. "Let some one stand at the foot of the tree and he would soon tell you its height." And there are people who can no doubt do this pretty exactly, but he would venture to say that if any six people of the present company attempted to do it, say with a tree of 60 feet high, the results would vary from 45 to 75 feet; and since a variation of 30 feet in a tree of 60 was not quite accurate enough for the Woolhope Club (a laugh), he would pass on to

The *second plan*, which was the *actual measurement*—that is, by sending a man up the tree with a pole to reach to the top, and a rope attached to it to

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reach the ground. This was certainly sufficiently exact, and there were trees which could not be accurately measured in any other way: for instance, if placed in the middle of other trees, or if they had a flat wide spreading top. It was nevertheless a vulgar and unscientific plan, and had such self-evident difficulties that he need not point them out.

The *third plan* was as pretty as it was simple and easy: the *measurement by the shadow.* Where the highest point of the tree is prominent and the ground is perfectly level (or if its rise or fall keeps exactly to the same inclination), this method is quite accurate. The plan is as follows: To stick upright a stick, three feet high, just at the point where the shadow of the top of the tree ends, then take the length of the shadow of the stick. The stick's shadow will represent a yard, and you have then simply to measure by it the distance to the trunk of the tree. This plan though often applicable is pretty sure not to be so with the particular tree you may wish to measure.

The *fourth method* is with *the mirror.* Place a small looking-glass horizontally on the ground between yourself and the tree at such a distance that you can see the reflection of the top of the tree in the glass. Now, since the angles of incidence and reflection of a ray of light are always the same, it follows that the angle from the tree top to the mirror must be the same as the angle from the mirror to the eye of the observer. Having measured the distance from the base of the tree to the mirror (by way of illustration let us suppose it 100 ft.), multiply this by the distance of the eye of the observer from the ground (say 5 ft.), and divide the product (500 ft.) by the distance from the mirror to the heel of the observer (say 6 ft.), and the result will give you the height of the tree (83 ft. 4 in. in this illustration). The mirror plan, however, again requires that the ground should be perfectly level, and, moreover, wants considerable practice even then to ensure its accuracy, for the smallest error in the multiplying or dividing figure would make a very great difference indeed in the result.

To the *fifth plan* he must call their particular attention. Everybody now who takes up any subject is expected to show some little originality, and in giving the plans of other people, to have a better one of his own (a laugh). Now this fifth plan was his own. He called it the *sketcher's plan.* Any of them accustomed to sketch would recognise the great use for keeping the relative heights of objects, of holding up the pencil immediately before the eye and thus measuring them. Mark a measured space on the tree and substitute a pocket scale for the pencil, and you have the means of getting its exact height. Let us suppose that you come to a remarkable tree. You measure first, say the circumference of the trunk, next you pin a card, or back of a letter, on the bark of the bole, at exactly 6 feet from the ground, and then retire to such a distance from the tree as will enable you by holding the scale against your eye easily to embrace the whole tree within it—60 or 80 yards will generally be ample for this purpose—the space on the scale

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occupied by the measured 6 feet, as compared with the space occupied by the whole tree gives the height. For instance, in the last oak tree he had measured, the 6 feet exactly occupied 4-16ths, that is one quarter of an inch, on the scale, and the whole tree occupied exactly 2¼ inches, just ten times as much, which gave at once 60 feet as the height of the tree. They would observe that by this simple plan it mattered not that the ground should be level, so long as you could see the whole tree—an immense advantage over most of the plans he mentioned already—and it signified not the more that the tree should stand perfectly upright, for if the tree sloped you had only to slope the scale in the same degree to get the length of the tree, and on this point it might be said to be superior to the more scientific methods he was about to mention, which only gave the height of the highest point from the ground below it (hear, hear). He was afraid, however, that he could not say much for the originality of this plan. It had doubtless occurred to one or two other people (a laugh) and they would remember in Thucydides that the height of the walls of Platæa was ascertained by the knowledge of the thickness of a single brick, and counting the number of courses of bricks to the top. It must be confessed also that this plan does require a *very steady hand* and a *very steady eye*, and in fact that its accuracy must depend so much on the observer himself, that he could only claim for it generally a close approximation to accuracy.

The remaining plans he would bring before them, all depend on the angle of elevation of the top of the tree being carefully taken.

The *sixth*, or the *Carpenter's plan*, was the most simple of these. He takes his "mitre square," and moves it nearer or further from the tree, until whilst the square is held true, as shown by its plummet line, he can look along the angle (the diagonal of the square, and therefore 45°), and just see the top of the tree. In order to see this, he knows that he must of necessity be placed at exactly the same distance from the tree, as the top of the tree is from the ground, or in other words, since the base and perpendicular sides of his mitre-square are exactly equal, the same angle extended will not be true unless both the same sides continue to be of equal length. He has then only to measure the distance from the tree, and add to it the height from the ground to his square to give the true height. This is a very ready excellent plan, but it also requires that the ground should be level or nearly so, and that neither bushes nor any other obstacle should exist at the exact spot required for the observation (hear, hear).

The *seventh plan* is to take the angle of elevation by the *Quadrant* in the ordinary way, and to measure the distance of the tree from the spot where the angle is taken, to transfer it to paper, and work out its height by a secondary calculation from the exact angle. He would not dwell upon this, because it was rather too troublesome to ordinary observers; it was, moreover, the exact method usually followed, therefore well known.

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The *eighth plan* is by means of Capt. Skyring's Clinometer. The little card he exhibited, with its plummet line, scales, and means of calculation all apparently complete. The angle of elevation is taken by looking along the upper edge of the card, and the measured distance to the object is multiplied by the four figures opposite the number of this angle in the table given. This Clinometer for any real accuracy would require not only a very steady hand, but two observers, that whilst one takes the angle the other may watch the plumb line, and mark it. The smallest unsteadiness of the hand would completely upset its accuracy, a fact which, it is to be feared, proves it to be little more than a mere plaything. It is small, however, and is carried readily, but the compound array of figures on the scale, added to the other difficulties, is not reassuring.

There are, doubtless, other "Clinometers" of varying kinds, but all of them require this secondary calculation, which makes an observer not naturally fond of figures anxious to measure the distance afterwards in some other way, to be sure that he has calculated the result rightly (laughter).

He would go on, therefore, at once to the *ninth method*, and the only one that is at once simple and mathematically accurate. It is the instrument Mr. Wells has invented, and which he had then the pleasure to exhibit to them. This instrument they could see consists of a geometrical square upon a stand, with a pivot and plummet line from the top corner. It may be called the quadrant squared. It will measure the exact height of any given object, a tree, a steeple, or a monument, and this whether you can approach the base of it or not, and whether, moreover, you are level with the base of the object, or above, or below it. It will give you the exact breadth of a river, or if you please, the inclination of a hill. In short, it will do what any other scientific instrument of a similar kind can do, and something considerably more. Herein consists its merit and originality. It does all its work without entailing the necessity of any secondary calculations whatever. It gives the result at once in the form you wish it. If you want to know, for instance, the exact height of any given object, in taking the observation, you had only to measure the base, set the instrument to the top of the object, and the point where the plummet line crosses the distance marks at once on the lower border the exact height. "Ah! that is taking the angle of elevation in the ordinary way," they might say, and so it was, no doubt, but it did not *note* the angle; instead of that, it gave you at once the exact measurement you required. The Quadrant and all other instruments based upon it take the angle of elevation, and having marked the angle, and ascertained the measurement of the base, they leave you to transfer it to paper and calculate the result in a more or less intricate fashion. One of his instructions from Mr. Wells was not to mention "angles;" you did not get them, and did not want them, since his instrument made all the calculations for you, and saved you from the fear of erroneous multiplication. "Talk of observations, sir, and not angles," said Mr. Wells, "and it will prevent confusion."

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Dr. Bull, who had illustrated the different plans as he came to them with rough chalk sketches on the black board, now proceeded to show in the same way the various methods of taking "observations" with Mr. Wells's instrument, and said that he himself had tested its exact accuracy in some instances by actual measurement with the tape afterwards.

In conclusion, he said that as it would suit his own circumstances at present, he would read to them the last paragraph of the letter he had received from Mr. Wells when he wrote in the first instance to inquire about the instrument. After showing how he was led on to invent it and what it would do, Mr. Wells wrote, "excuse my taxing your patience so much; but when I tell you that I have been riding this hobby for four or five years, you will forgive me. My real opinion is that for simplicity, accuracy, despatch, and general adaptation, the instrument has no superior. This is puffing, certainly." Now, he agreed with this paragraph, except as to the last four words, for he did not think "truth" could be rightly called "puffing" (applause).

The President then said he would take that opportunity of making one other remark, and that was upon the extraordinary absence of any remarkable trees on the Ross side of the county. He had heard there was a fine oak near Ross, a fine elm at Marcle, some fine yew trees here and there in the churchyards, and many fine elms at the Hill Court, but, as a matter of course they could not exist, since, in spite of all the notices sent out by the club, not a single answer had been received by Mr. Cornewall, the honorary secretary (laughter). It really was very curious, because the Ross district was the elm district of the county; but he hoped, if the inference he had thus drawn was not correct, that some gentleman or other would at least write and tell the secretary what fine trees did exist in this district, and where they were situated, that the club in its perambulations might take some opportunity of measuring and describing them.

The President then said that Mr. Alfred Purchas would now read to them a paper on "the Lepidoptera of Herefordshire." It was the first paper on Entomology that had been brought before the club, and he trusted that it would shortly be followed by others.

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LEPIDOPTERA OF HEREFORDSHIRE.

BY MR. ALFRED PURCHAS.

In the few years in which I have studied Entomology in this district I have met with very fair success, and have reason to believe that Herefordshire, although not producing many of the very rare or local species, is exceedingly rich in the more common Lepidoptera. In butterflies (*Diurni*) especially, the commoner species of which abound in our woods, lanes, and banks, and help, by their gay and gladsome appearance, to render our county so attractive to the tourist. We have the beautiful Peacock, Tortoiseshell, Sulphur, Speckled-wood, Large Fritillary, and the delicate Orange-tip, and Small-blue, abundant every year. The handsome Red Admiral, Comma, and Painted-lady are also often abundant: the latter was remarkably so in the summer of 1865. Of the more rare butterflies, the Wood-white is to be met with in Penyard. The Holly-blue, Large Tortoiseshell, the Ringlet, and the Pearl-bordered Fritillary are of frequent occurrence. The Grayling is also to be met with in the northern parts of the county. Of the commonest species it is needless to make any remark. With the Garden-whites most of us, especially those who have town gardens, are only too familiar, and the Meadow-browns are everywhere abundant. Of the whole 65 British species I have as yet taken 30 in this county. The Rev. Mr. Hutchinson, of Grantsfield, near Leominster, has added 9 to this number. The remaining 26 are either very local, or so rarely occur in England, that I have never even hoped for a better representative in my cabinet, than a foreign specimen. Of the caterpillars of the butterflies, very little is as yet known, save of the Garden-whites, Tortoiseshell, and some few others.

The butterflies are the only division of the Lepidoptera that attract the attention of ordinary observers, and consequently form the grand staple of all rudimentary collections, from the schoolboys' half-dozen Small-blues, Sulphurs, and Garden-whites, upwards.

It is a common mistake to class all bright-coloured Lepidoptera as butterflies. This is very far from correct, as we have hundreds of most beautifully-coloured moths (*Nocturni*), presenting every variety of shade, which, from their being mostly night-fliers, generally escape the observation of all but the scientific hunters for them.

The first division of moths contains the large Hawk moths, the Burnett, and Clear-wings. The Poplar-hawk, the Privet, and the Eyed-hawk appear to be at times rather plentiful. The Lime-hawk also occurs sometimes. The Death's-head, too, our largest moth, in some seasons is quite common in the caterpillar state. In 1865, owing to the very long summer, it was remarkably abundant. Its handsome violet-spotted grub was frequently seen feeding

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on the potatoe haulm, and strong as this is, it seemed almost too fragile to support its bulky body. This insect is very rare in the perfect state. I have not yet been able to rear any of the numerous caterpillars that have come into my possession. The Humming-bird moth was also remarkably plentiful last year (1865).

The "Eyed hawk moth," one of my finest specimens, was obtained from some boys who had picked up the caterpillar under a weeping-willow growing in Ross, and were carrying it about. On inquiring what they were going to do with it, they answered "*roast it.*" "Well," I thought, "if entomologists are said to be cruel (which is never necessary), we at all events do not inflict such horrible torture as *roasting* on our victims, and if I rescue this poor wretch from its impending fate, put it comfortably away in my breeding-cage till it is ready to change, and when the moth comes out give it a few minutes in a tin box, with the agreeable smell of bruised laurel leaves, which causes speedy stupefaction, I shall almost deserve the thanks of the Society for the Prevention of Cruelty to Animals." I soon prevailed on the boys to give it up, for they fortunately saw their way to as much fun in spending a penny or two, as in roasting a plump caterpillar, the flavour of which might not have recommended itself to English palates.

One, at least, of the prettily spotted Burnets (*Zygæna filipendulæ*) is very common. The singular-looking Clearwings have only one representative (*Sesia Tipuliformis*) that is at all common; the remainder are most of them very rare.

The next group (*Pseudo-bombyces*) contains some of the most handsome English moths: these, from their being mostly "spinners," are often met with in the cocoon. They appear to be fairly represented in Herefordshire. The most familiar example is the Tiger-moth: the Miller-grub, its caterpillar, is a remarkably lively specimen, running about everywhere and eating everything—few garden plants seem to come amiss to it. In its perfect state, it is, however, much more shy, never moving out until after dark. It is, nevertheless, attracted by light, and may frequently be found buzzing round lamps and windows at night. The Brown-tail is another familiar example; the caterpillar feeds on hawthorn in June, and from its pretty appearance (black, with white and blue spots and stripes), is a great favourite with children; the moth is a very plain, quiet-looking, white insect. Another example is the "Cinabar" moth, which is quite a day-flier, and from its handsome appearance (very dark ground with crimson spots and stripes) is frequently dignified by the name of butterfly. The caterpillar is black with yellow transverse stripes, and feeding chiefly on groundsel, is often abundant in gardens.

The "Puss moth" and the "Goat moth" are two of the largest and most remarkable species in the group, both are frequently found here. The next group (*Noctuæ*) is generally characterised by dull coloured moths, seldom showing themselves but to those who look specially for them. There are,

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however, one or two exceptions to this rule. The "Old Lady-moth" is very fond of coming into a lighted room in an August evening. The "Red Underwing" and the "Yellow Underwing" may often be seen flying about in the day time, but seldom unless disturbed in their resting-places, or to sun themselves in a very hot day. The species *Plusia Gamma* may be seen buzzing round the flowers of the Scabious in the sunshine on a September morning. The "Hart and Dart" and some others are very abundant.

The greater number of the remaining species—some 300—are only to be got by artificial means, viz., by putting a mixture of sugar, rum, and beer, on trees at night, and looking for them with a lantern. If the evening be damp and favourable great numbers may be taken in this way. Of this group I have as yet taken only 62 species, many of the remainder are very scarce.

The only remaining group that contains any large or showy moths is that of the *Geometræ*, so called from the singular formation of the caterpillar, which in crawling loop up the middle of their bodies. The moths are shaped much more like caterpillars than those of any other group. The "Large Magpie" or "Gooseberry Moth," is one of the most common, generally abounding in gardens. The beautiful "Emerald" and the delicate "Swallow-tail" are occasionally to be found. They are two of the most prominent insects in the group, which presents an almost endless variety of delicate markings.

In the next group (*Tortrices*), the moths are nearly all of them "leaf-rollers." They appear to be well represented in this county, especially by one individual, the Green Oak-moth. This is remarkable for the destruction it causes in the caterpillar state. In the year 1862 this creature completely denuded the oak woods of foliage, making them, in the beginning of June, look quite brown, instead of the verdant appearance they usually present at that time. The caterpillars were so abundant that in a very short time they ate up, or destroyed by rolling them up, all the oak leaves, and to prevent starvation, took to the leaves of the nut, maple, and other trees. This had the curious effect of compelling the other tree-feeding caterpillars to descend and hunt over the ground for a substitute for their proper food. From this cause, many species were thus to be met with that cannot usually be obtained without the trouble and difficulty of climbing for them. The division has about 300 species.

I will not detain you by commenting at any length on the remaining groups. We have a familiar example of one of the *Crambites* in the little Grass-moths, which are so abundant after midsummer; and of another, the *Tinena*, in the Clothes-moths, which need little description, as most housewives know its provoking habits only too well. I may, however, observe that it is not the moth, but its caterpillar that commits such destruction: it makes itself a woollen jacket, in which it lives and feeds, and in this disguise often escapes destruction, being taken for nothing more than an empty cocoon.

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It is much to be regretted that the study of this branch of natural history is so much neglected, as, if Herefordshire were thoroughly well worked, there is little doubt a large number may be added to the known species. The total number of British Lepidoptera is so large, amounting to nearly 2,000, that this class alone affords an almost boundless field for careful study.

It appears by a list which I have carefully compared with my own, that Mr. Hutchinson and his family have met with great success in the neighbourhood of Leominster, and have added many species which have not before been found in the county.

During the time Mr. Purchas was reading his paper, his collection of the Lepidoptera was passed round the room. It consisted of eight handsome cases, in which the insects were scientifically and very beautifully arranged. The collection is a very extensive one, and contained several species not found in this county, some of which, indeed, are now scarcely to be met with in the kingdom.

Here was the interesting "Swallow-tail" (*Papilio machaon*) with its handsome black-bordered wings. It is only to be found naturally in the fens, and the chrysalis, hanging tail uppermost from the bullrushes, is much sought after for sale. These were imported in this state from Cambridge, and thus in one sense may be said to be Herefordshire born. There was the "Black-rimmed white" butterfly of the thorn (*Pieris cratægi*), a very pretty representative of a most destructive caterpillar on the continent. It is fortunately rare in England, and only appears at long intervals. This one was caught by Mr. Purchas's brother, near Chepstow, a few years since. There was a specimen of the very rare "Bath white" (*Pieris daplidicæ*) with its mottled underwings. This butterfly is called the "Bath white" from an elegant piece of needlework executed at Bath, in imitation of a butterfly of this kind taken near that city. The "Clouded yellow" (*Colias Edusa*), which should rather be called orange, so rich is the tint of colour, and the very rare "pale clouded yellow" (*Colias hyale*) were there also.

Next, and most striking perhaps of all, we must notice the fine specimen of the "Camberwell Beauty" (*Vanessa Antiopa*). It is so called from having been observed in great abundance amongst the willow beds at the village of Camberwell. This is now one of our very rare butterflies, though about 20 years ago it appeared in such immense numbers throughout the kingdom that the Aurelians of that day thence gave it the name of the "Grand Surprise." It now only appears in small numbers, periodically, after lapses of five, or ten, or more years. The specimen in Mr. Purchas' case was a foreign one.

Not so the "Purple Emperor" (*Apatura iris*); this has long been known as a Herefordshire butterfly, and "Brinsop copse" is generally mentioned as a locality for it. It is considered a great acquisition in any collection, not only for its own handsome appearance and colour, but also

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because it is so difficult to catch. It frequents the tops of the highest trees in the middle of woods, and enthusiasts are said to hunt for it with butterfly nets on poles 40 feet long! Its caterpillar, too, which is pale green, is very difficult to find. It has a wide range, however, and is not therefore probably so rare in nature as it is in ordinary collections.

The "Wood White" (*Leucophasia sinapis*), by no means a common butterfly, Mr. Purchas was lucky enough to capture one fine morning on Penyard hill, near Ross. Then there was the "Scotch argus" (*Erebia blandina*) with eyes on its wings—(a representation, by the way, common to many butterflies). It was not a Herefordshire specimen, of course. It is said to occur sometimes in the northern counties of England, but its true home is in Scotland. Here it is not very uncommon, and hundreds of them may sometimes be seen flitting about in the sunshine on the thistles beneath the columnar trap rocks in the Queen's Park, called "Sampson's Ribs."

Close to this also was the "small ringlet" butterfly (*Erebia cassiope*), also rare and confined to the northern counties. Then there were many choice varieties of *Polyommatus* (or many-eyed) tribe, the "Clifden blue" (*Lycœna Adonis*) whose wings present a most lovely, shining, silvery azure blue, the most splendid of all the British blues; the rare "Mazarine blue" (*L. acis*); "the silver studded blue," (*L. œgon*) the "large blue" (*L. arion*) very fine and very rare, and several others. There was the "Brown Hair-streak" (*Thecla Betula*), and the still more rare "Black Hair-streak" (*Thecla Pruni*); many rare Fritillarys, *Argynnis Lathonia*, *Adippe*, *Aglaja*, and *Selene*; several uncommon Skippers *Hesperia Paniscus*, *comma*, and *linœa*, &c., &c. The completeness of the collection may be judged from the presence of these varieties amongst the butterflies. The other classes of the Lepidoptera presented also numerous rareties, which would delight the eyes of an Entomologist. The list is too long to attempt now. We can only say, what we feel sure is correct, that Mr. Purchas would be happy at any time to show his collection to any lovers of the science if they would call at his residence in Ross.

The time was now drawing to a close, and although Mr. Blashill had prepared all the illustrations for his paper on "Variations in the water *Ranunculi*," there was no time to read it. It was, therefore, postponed for a future meeting. A paper on "Herefordshire Yew Trees," by the Rev. Thomas Woodhouse, M.A., of Hay, was also postponed. So finished a very pleasant meeting, and the committee must have felt, when they got home, much as the farmer did when he innocently said, as soon as he had got in his own hay, "What a blessing for the country a good day's rain would be."

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The Woolhope Naturalists' Field Club.

MEETING AT BUILTH,

AUGUST 24TH, 1866.

The fourth field meeting of the Woolhope Club for the present season was appointed to be held at Builth, on Friday last, the 24th ult., and most attractive programme showed that the energetic President of the Club (Dr. Bull) was resolved that none of the meetings during his year of office should be deficient in interest. Carlyle has well remarked that "a man will see as much as he brings power to see"; and it may also be observed, that a man will get over as much ground as his legs give him power to do in sufficient time. This is too often forgotten when the programme of an expedition is made out, and thus it often happens that many beautiful parts of a projected excursion have to be "omitted in the representation," as players say. But Dr. Bull had too much foresight to be upset in his plans by this miscalculation, and a rehearsal the day before soon pointed out what was impossible to accomplish, and the route varied accordingly. Still, as it was all nearly done by the President, in company with a botanical friend, we shall give our readers the advantage that would have accrued to them and the Club had they taken the entire route indicated.

We have been favoured by the Rev. D. P. Davies and others with some notes on the history of Builth, which we shall take advantage of in due course, but in relating the transactions of a Naturalist's Club, it may be well to give early prominence to natural objects—the rocks, wood, and water—that equally invite the pencil of the artist and the descriptive powers of the lovers of nature.

The scenery surrounding Builth is very attractive and distinguished for its richly diversified and picturesque character. The sportive Wye, here still in its infancy, has all the varied charms that a river possesses before it entirely leaves the rocks that have encompassed its mountain home, and according to the fulness of the stream is the rapidity with which it flows. At times still and sedate, at others it rushes over or plays among rocks of all sizes, forming numerous eddies and little cascades, or it spreads out widely in sparkling gravelly shallows, ever amusive and exciting, and it receives

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further beauty from the thick foliage that in many places adorns its banks. Beyond the confines of the valley, huge mountains on either side give majesty to the scenery.

Proceeding from the old bridge of Builth, with its six stone arches, to which time has given rather a solemn character, and passing the railway station, the mossy turf of the Carneddau range is soon reached. A very steep path winds upwards among rocks that are unmistakeably of igneous origin. It is well to turn from it to some projecting rocks on the shoulder of the mountain. Here, spread out before you, are the windings of the Wye through the valley, the pretty town of Builth itself with its meadows and pleasantly wooded hills,—opposite to you is the Garth—from this point an isolated cone,—whilst stretching out beyond it is the range of the Epynt, and mountains upon mountains that appear in every variety of light and shade. All this is seen in varied form as the winding path is followed to the summit of therange. From the western side beyond Blaengowen the hill projects boldly forwards into the valley by the point called the Craigddu, from which also an excellent view of the adjacent valleys and hills is obtained.

There might have been considerable doubt as to the weather, but the dwarf thistle *(Carduus acaulis)* spread wide its calyx, and the botanists went cheerfully forward. The thistle and science were right too, albeit in direct opposition to local authority, for the weather turned out to be everything that could be wished.

In the walk over the Carneddau some noteworthy plants were observed. The pretty English stonecrop *(Sedum Anglicum)* was particularly abundant on all the projecting rocks, though this plant generally prefers such as are within reach of the seaside. The purple flowered orpine *(Sedum telephium)* was also found—and in several places a small forest of fine grown seed stems of the foxglove *(Digitalis purpurea)* was observed.

The bleak summit of the mountain is covered with the gray reindeer lichen,

"The wiry moss that whitens all the hill,"

as Crabbe designates it, and which must give the spot rather a dreary aspect when the fogs of November emcompass it. Now it was all tempting to a wanderer, and the sun, though among clouds, shot out between them here and there, marking out with artistic effect the distant mountain ranges.

To botanists, however, the chief attraction was the bog, situated in a hollow space at the top of the hill. This seems formerly to have been a lake or large pool, but is now nearly choaked up with plants; rushes in plenty, surrounded with tufts of the *Sphagnum* or bog moss; an abundance of the rare and elegant marsh St. John's wort *(Hypericum elodes)*; the marsh Cinquefoil *(Comarum palustre)*, with its beautiful leaves and maroon coloured flowers; the bog bean *(Menyanthes trifoliata)*; the not very common *pedicularis palustris*; the penny-wort *(Hydrocotyle vulgaris)* hid itself as usual beneath everything else; and the pretty cotton grass *(Eriophorum angusti-*

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folium) with its white-robed head of seed waving in the wind, and tempting you to gather it—if you dare—for no sooner do you get near it than down sinks the treacherous *Sphagnum*, and the black water covers your boots with threatening rapidity. Thanks to these masses of moss, however, for upon them grew the pretty round-leaved sundew *(Drosera rotundifolia.)* This interesting little plant derives its name from the fact of the long red hairs which grow from the upper surface and edges of its leaves, supporting, each one of them, a drop of clear fluid, like dew. It is ever present in the hottest and most sunny days, if, indeed, it is not more abundant then—

"By the lone fountain's secret bed,
Where human footsteps rarely tread,
Mid the wild moor, or silent glen,
The *Sundew* blooms unseen by men;
Spreads there her leaf of rosy hue,
A chalice for the morning dew,
And ere the summer's sun can rise,
Drinks the pure waters of the skies."

Two couples of wild ducks, starting suddenly up from the bog, put to flight all poetic fancies and recalled attention to the setting sun. Guided by Mr. David Griffith, whose attentions to the visiting naturalists call for marked commendation, the descent was rapidly made over walls and hedges and ditches, down charming meadows, and through one dense thicket to the Werntoe dingle, where in the dark Wenlock shale, which the brook has exposed to view, the *Ampyx nudus* is said to abound. It was too late, however, the shades of evening were quickly deepening, and in its recesses on the present occassion only a few fragments were discovered. In this progress it became evident that some varieties of bramble were to be found about Builth, and the President formed an acquaintance with *Rubus Kœhleri*, too close to be agreeable. Passing by the pool and grounds of Pencerrig, the march was taken to Builth, and head quarters fixed at the Lion hotel.

Here it may be as well to pause and look round upon the town of Builth itself, and note its curiosities and antiquities.

BUILTH.

This town, by the consent of all tourists, is beautifully situated, in one of the most salubrius and picturesque vales in Gwalia. On the south it is bounded by a spur of the Epynt, a hill made classic by its "Bugeiliaid" shepherds in the writings of the late Brutus of Llandovery. On the east the pyramidical Garth and the pasture lands of Radnorshire appear. On the north the famed Llanelwedd and Penmaenau rocks stand like faithful sentinels to temper the northern blast, while the cultivated fields and picturesque plantations of Llanelwedd Hall and Wellfield seem to rejoice in their protection. Yonder, on the west, are knolly and undulated lands, resting on the banks of the Irfon and Chwefry, stretching far off to the Llanwrtyd, Abergwesyn, and Llanowen Hills, known by the name of Maelienydd, one of the wildest and least known parts of Britain, and may be called "the great desert of Wales." Giraldus calls them Ellenydd—in early

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English "Morugh" or moors—*i.e.*, the heights of marshy places, which is the meaning of Ellenydd, according to Leland. From these hills the Irfon takes its rise, flowing rapidly through Llanwrtyd and Llangammarch as if in haste to join the romantic Wye as she descends from the peaks of Plinlimon, and thus combined they pass the pretty town of Builth as they meander down the vale.

The town is irregularly built, consisting of two main streets which, meeting in an angle at the Swan inn, unite and afterwards extend for a considerable distance along the road leading to Llandovery. The population of Builth by the last census is only 1,100, but through the summer months the renown of its saline wells brings many hundreds of visitors there.

The view from the handsome bridge of six arches, erected in 1770, which spans the Wye, especially if the day be bright, is perfect of its kind. The history of the place may be indicated by the following events. Its Welsh name *Buallt* is said to be derived from *Bu* an ox, and *allt* a wooded eminence, signifying an ox-cliff or oxen-holt. In ancient documents it is styled Llanfair-yn-Muallt—this was evidently a great grazing county. Camden and others claim for Builth great antiquity. The town in ancient days is said to have extended from a brook on the east side of the Castle called Glyro, from its contiguity to a centinel's station, to another brook called Llogyn falling into the Irfon on the west, and if so it was a mile in length. In the neighbourhood are several entrenchments in which Roman bricks with the inscription "Leg. II" have been found. In recurring to the Chronicle of Caradoc we find this place suffered considerably from the Danes in 893, who, being pressed by Alfred, sailed to Wales, and after destroying the country round the coast advanced to Buallt, which they likewise demolished. The present town appears to have arisen subsequently to the erection of a castle by the Norman invaders of this part of the principality, under Bernard Newmarch, brother to William the Conqueror, as some hold, in the year 1078. Phillip De Breos, one of Bernard's followers, attacked and conquered the territories of Elystan Llodrydd on the river Wye, established in them the Lordship of Buillt, from which circumstance he is styled "Lord of Buillt," which he obtained by conquest. He, no doubt, strengthened and enlarged the castle, the foundations of which, including some very strong earthworks, exist at the east end of the town, and make a conspicuous appearance. The keep stood on the lofty moated mound in the centre, which is many yards (50) in circumference; the state apartments and offices were on the south-west side, to which there was a branch from the inner moat. Sir Roger Mortimer held it for the Crown in 1260, but it was taken by Llewelyn ap Gruffydd, who, as some historians say, held it till his death, when the garrison betrayed him. There is but a small portion of a wall now remaining. It is situated on the north side, and to judge from this, the walls must have been of considerable thickness. It is built, however, of the crumbling blue shale of the district, and could never have successfully withstood an attack of artillery. When or by whom the castle was destroyed is not known.

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In 1282 this town and neighbourhood were the scene of the "Struggle for Welsh Independence," to which a period was finally put by the death of the gallant Llewelyn, the last native sovereign of Wales. The story of Llewelyn's fall has been frequently told, but like other memorable events it never palls on the mind:—"After the brilliant success which attended his arms at Menai Straits, he was to hold a conference with some chieftain in this district. Llewelyn for this purpose came to Aberedw, about four miles below this town, where he had a castle or mansion, and there passed the night, having posted a part of his army at Pen-y-coed a'r Irfon, two miles above. During his stay he was alarmed by the approach of the enemy, who had received intelligence of his movements and present situation; and being nearly surrounded by the forces of the English, under the command of Sir Edmund Mortimer and John Giffard (who had marched from Herefordshire) he, as is commonly stated, caused his horse's shoes to be reversed in order to mislead his pursuers by the impressions on the snow, which then covered the ground. This stratagem, however, being treacherously discovered to the English by Madoc Goch Min Mawr, the blacksmith whom Llewelyn had employed, a pursuit was commenced. Llewelyn fled towards Builllt, crossing the bridge over the Wye, which he caused to be demolished before his pursuers came up, who were consequently compelled to return to a ford eight miles lower down on the river, where they effected a passage at Cafan Twm Bach. Meanwhile Llewelyn had sought succour from the garrison at Builllt, which being refused either from dread of the presence of an English force, or from treachery, he lead his party westward up the Vale of the Irfon, and crossed that river a little above Llanynis church by a bridge called Pont-y-coed, where he stationed his men. The English coming up made an unsuccessful attempt to obtain possession of the bridge; Elias Walwyn, a retainer of Rhys (Lord of Builllt) offering to conduct Giffard by a ford to the very field where Llewelyn waited. The attack was then purposely renewed with fresh fury; and while this was being carried on, Gifford crossed the river in silence, and under cover of the intervening wood, charged down on the spot where Llewelyn was conversing, unarmed, with his secretary. By what particular hand the Prince fell can only be conjectured. Adam Francton claimed the dishonour of this murderous act. A friar of a neighbouring monastery (whose opportune presence in the Norman ranks can only be explained on the supposition that the conspirators had been enjoined from the highest quarter not to stop short of the death of their victim) administered to him the last rites of religion, and received his expiring breath. His head was then cut off and sent with all papers found on his person to Edward at Conway Abbey. The head of the patriot hero was thence conveyed to London, was placed (encircled in mockery with a silver crown) on the highest turret of the Tower. Thus perished, December 22, 1282, in the 48th year of his age, in the words of the learned Seldon, "as great and worthy a Prince as ever the third-part of this island was ruled by." The place where Llewelyn was slain is in the

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parish of Llanganten, and has since been called Cwm Llewelyn, or Llewelyn's dingle. As faithful chroniclers we are bound to state, that the friends and adherents of the English Monarch, and the Lords Marchers in the hundred of Builth, not satisfied with betraying their unfortunate countryman, endeavoured to blast his memory by the imputation of cowardice. Because he was not slain at the head of his troops, they spread the report that he was found ingloriously lying at full length in a field of broom, and that on receiving his death wound he cursed the treacherous plant for not concealing him more effectually, and they say that since that time none will grow on the spot. It seems most probable that he was killed by surprise when reconnoitring the motions of the enemy on the other side of the river.

There is some probability from tradition that the great plague in the early part of the fourteenth century visited Builth severely, as it did so many other towns and cities throughout the country, although it is nowhere mentioned as having done so. About a mile westward of the town runs a small brook called Nant-yr-Arian, or "the money brook," and here it is said that the country people brought the provisions to supply the town and left them, and were paid for them by money dropped into the running water so as to avoid the risk of infection by those who received it.

In the year 1691 the town was nearly destroyed by fire which broke out on the 20th of December in that year; the loss sustained by the sufferers who applied for relief under this calamity was estimated at £10,780, and by persons of more independent property, who did not make application, about £2,000 more. Letters-patent were granted by the Crown, authorising the distressed inhabitants to gather alms from charitably disposed persons throughout the kingdom, and under this authority a few hundred pounds were collected, but the money was so misapplied that only one house was re-built from the fund. In this instrument, which is illumined with the portraits of King William and Mary, it is stated "that the fire raged for five hours, and that from the boisterousness of the wind, it consumed the dwellings of 41 substantial families, with all their corn, furniture, effects, and merchandises, to the great impoverishment of the adjacent country, and delay of trade, it being a very considerable market town, and having no other market kept within ten miles of it."

We ought here to mention the mineral springs near Builth, which are said now to attract many hundreds of visitors every summer, and in Pryse's account of the "Breconshire and Radnorshire Mineral Springs," are stated as "combining the mineral properties of those at Llanwrtyd and Llandrindod." To this statement we do not pledge ourselves; but this may be said, that as some of the Club paid a morning to the spa and pump-room, it was found on inquiry that visitors are supplied "with as much as they like to drink of the saline, sulphur, and chalybeate waters for threepence each," as the attendant nymph declared, "and drink as much as you like."

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The mineral wells of Builth, like the most valuable springs on the Continent—and, indeed, almost everywhere else—arise near the point of contact of the igneous with the stratified rocks. Here, as at Llandrindod and Llanwrtyd, they issue on the western side.

The *road* to the springs is as uninteresting as well can be; through narrow, dusty lanes, and between high hedges; but there is a way from the common by the banks of the Wye and the Irfon, and round through the woods, which is exceedingly pretty. It goes over a foot suspension bridge across the river Irfon, which is very picturesque but rather a shaky affair nevertheless, when any larkish person causes it to vibrate, as was done on the present occasion, to the dismay of some frightened damsels coming over the bridge. The grounds of the Wells might be made varied and beautiful. In fact, everything relating to the Wells makes a stranger wonder what the proprietors of these powerful waters are about that they should be so little alive to their own interest. A few hundred pounds laid out with judgment and taste would do more than thousands in many other places. Builth itself is alive and progressing with the times; but why should all the attraction of its mineral springs be solely left to the virtues of the water?

There are some strangely named places in the vicinity of Builth, one of which, on the road to Hay, is called the "Devil's Pitch," though to mortal eye there does not appear to be anything very demoniacal about it. It is said to be connected with tales of olden sheep-stealing times, with which Breconians of the last century were connected, to the peril of their necks, and hereabouts some informer was "pitched," it has been whispered, into the Wye, and, some thought, to the devil too. This is one of those local stories that may or may not be true. However, in the present day, as the Wenlock shale is here exposed by a cutting in the road, the "Devil's Pitch" has received geological attention from a new trilobite, called *Phacops Daviesii*, having been found here, with an abundance of *Orthoceratites;* and at this point Dr. Bull, with a band of ardent geologists, laboured for some time before the club arrived, and not without success, to extract specimens from the fractured rock.

The train from Hereford reached Builth about twenty minutes past twelve, and, without any loss of time, the active President marshalled his forces, which numbered about fifty gentlemen, and reminded them of the value of time in a district of such great geological interest. He told them that it was arranged that four quarries would be visited in succession that day, and that since every succeeding one would advance in interest, they must not lose time at the beginning. He hoped they would promptly obey orders, and, instead of thinking him rude, would remember that he was only taking them to better things. They would first visit the Cwm-Henllan Dingle, close to Wellfield Lodge. The march then began; a brief pause being made at Gwenstone quarry, where the volcanic grit of the Carneddau rocks is worked for building stone. A man had been sent forward with a pick to the Cwm-Henllan

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dingle to get out some slabs of the Llandeilo flag ready for more careful splitting and closer examination, and here a most lively scene soon presented itself. The narrow dingle was soon filled by enthusiastic geologists, hammering away in such close proximity that it was a marvel that no accident happened. A few specimens of the *Ampyx nudus* and *Ogygia Buchii*, together with one or two of *Diplograpsus pristis*, with here and there a *Lingula* or a small portion of *Trinucleus*, were all that were found when the President's whistle sounded and the march for Pencerrig began.

On their emerging from the dingle some ladies on horseback joined the party and added much to the picturesque effect of the group of naturalists. The grounds of Pencerrig were soon reached, and a direct line was taken across the park for the quarry at the pond-head. Here the upper Llandovery rocks and the Llandeilo flag are developed in the quarry, while the Wenlock shale appears in the bed of the Melton brook, which at this point runs from the pond. Excellent specimens of the *Pentamerus oblongus* were also readily obtained from the upper Llandovery rock in the quarry under the guidance of Mr. Griffiths, who knew exactly the proper place to look for them, and from the shale in the brook specimens of *Graptolites ludensis*, and *G. Murchisoni* were obtained. The brook here dives down amongst dense foliage into the deep gloom of a narrow, shaded dingle. A whisper was breathed that fresh-water lobsters lived in it, and one gentleman bent on verifying the fact set out to hunt, and quickly returned with a fine cray-fish or craw-fish (*Astacus fluviatilis*), which he presented to the President. The time had now arrived for the Address, and the party arranged themselves on the grass, and on the banks, and in the pleasant shadow of the trees, and listened to the following instructive address.

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THE GEOLOGY OF THE DISTRICT.

By the Rev. W. S. SYMONDS, President of the Malvern Club.

On the present occasion our time is so limited, owing to the unpropitious hour of the returning train, that I can do little more than give a very hurried and imperfect sketch of the interesting geology of the Builth district. You are probably aware that during the far distant geological period, known as the Lower Silurian epoch, there were active volcanoes, and two periods of volcanic outburst in what is now North Wales. Volcanic action seems to have commenced in the Cambrian period, and to have increased during that of the deposition of the Lingula Flags, but the internal forces became more intensified during the period when the strata known as the Llandeilo deposits were accumulating in the Lower Silurian seas. The second period of volcanic action occurred towards the close of the Caradoc or Bala period, and the noble Snowdonian hills, which run from Moel Hebog by Carnedd Llewelyn to Conway, are composed of strata of the Caradoc age, interstratified with submarine lavas and volcanic ashes, all of which have long since been upheaved into the noble hills the geologist loves to traverse, and which display along their scarped and rugged rocks the histories he learns to read.

It was during the earlier period of this volcanic activity that the ancient igneous rocks of Builth were erupted. The great Arenig mountains in Merionethshire are made up of repeated streams of lava interstratified with sedimentary strata of the Llandeilo age, containing fossils and volcanic ashes, and these Arenig rocks are older than those of Snowdon, as proved by the superposition of the Snowdon rocks and their organic remains. The Arenig rocks belong to the Llandeilo period, which preceded the Caradoc period.

It was during the latter part of the Llandeilo period (upper Llandeilo), and when volcanic action was also rife in North Wales, that the volcanic forces burst forth through the upper Llandeilo strata in this region of Builth.

Here you have repeated on a small scale the interesting geology of some of the grandest hills in North Wales. Here you may see old lava streams of the Llandeilo period, and the interstratified beds of volcanic ash which were showered down from a neighbouring crater into the surrounding sea, and which ash and pumice sunk gradually through the waves, and became interbedded with strata, which contain the fossil remains of the mollusca and crustaceans which inhabited the Llandeilo seas. I last month saw strata of the Tertiary fresh water lakes of Auvergne, interbedded with stratified ashes and peperino, and traversed by lava dykes, while the stratified deposits were full of the cases of caddis worms, and fresh water shells that inhabited the

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old lake. The rocks of the Carneddau Hills, that form so picturesque a feature near Builth, are composed of igneous rocks both eruptive and stratified, and these run to the north east to Llandrindod and Llandegley. In many sections in the neighbourhood the old lava currents may be seen elevated through the overlying sedimentary deposits, and throwing off the Llandeilo strata, and interbedded with flagstones which contain the well-known Llandeilo trilobites.

Perhaps the most instructive section is that typical section given by Sir R. Murchison, in "Siluria," viz., that on the N.W. slope of the Gelli Hill, where felspar porphyries, like those of North Wales, may be seen interstratified with Llandeilo flags, containing that typical trilobite the *Oggygia Buchii*.

Another section, very instructive, is that on the Wye, above the celebrated salmon catch, called the Rocks. Here, the Llandeilo strata may be seen broken through and altered by the volcanic masses and worn down in the river bed. The fisherman can always tell when he is wading over the igneous, or the stratified rocks, the latter being so much more slippery than the rough lava beds.

Another feature the physical geologist will not fail to remark, is the excavation of the softer Llandeilo shales, and the longitudinal valleys scored out by denudation, the hard trap rocks standing out in hill ridges. This tells its own history. The mineral waters of Builth, Llandrindod, and Llandegley, owe their origin to the decomposition of iron pyrites at places where a lava rock traverses and alters the Llandeilo strata. The waters of Moffat, in Scotland, known for their chalybeate properties, take their rise through a fissure of Llandeilo strata charged with graptolites and altered by an ancient lava dyke, precisely as occurs in this district. I have been asked if it was possible to point out the site of the ancient volcano from which the igneous rocks of the Builth districts were poured forth. It must be remembered that much of the old lava was evidently evolved through fissures into the bed of the Llandeilo sea, for they were soon covered up by sedimentary silts and strata. Still, the volcanic ash of some of the deposits tell of a volcano which must have had its crater above the waves to have showered forth such light materials into the air. We must, however, remember the total submergence of this country more than once since the period of Llandeilo volcanos, and that in all probability we only now behold the basement rocks of those volcanic masses which once existed along this line of ancient earthquake action and volcanic eruption.

Long after the lava rocks of Carneddau had become as hardened and as cold as they are now, volcanic action burst forth again, and molten masses were poured through rocks of a much later date only a few miles from hence. I allude to the well-known trap rocks of Stanner and Old Radnor, which on the north of Builth traverse and alter rocks belonging to the Upper Silurian epoch, the Woolhope or Lower Wenlock beds. I have no

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time to allude to the Palæontology of the rocks in the neighbourhood of Builth, further than to observe that the fossils of the lowest stratified deposits of the district inform us that the oldest strata here belong to the age of the *Upper* Llandeilo beds, of which the well known Trilobites *Ogygia Buchii* and *Asaphus tyrannus* are characteristic fossils.

There is one point to which, however, in conclusion, I should like to ask the attention of local geologists. The *drifts* and gravel deposits of this neighbourhood are particularly worthy of attention. There are in the first place, high upon the summit of the hilly platform, *marine drifts*, which were no doubt deposited when the whole of this country, like the greater part of Europe, was submerged beneath the waters of the glacial seas. There are also ancient *river drifts*, which are the result of an ancient Wye which flowed at a level far higher than the existing river, and which, fed by winter ice and snow, which filled every vale and covered every hill, swept down under each summer's sun as a torrential and rock-bearing stream. There are atmospheric *drifts*, by which I mean those local deposits which are the result not only of the *existing* atmospheric influences of rain, and frosts, and snows, but the deposits of the later part of the glacial epoch, which affected this country ages after the emergence of the land from beneath the glacial seas, and when its physical contour was much the same as at the present moment. The climatial adaptations were, however, *far colder*. Glaciers swept down from the higher hills through the hill valleys, and winter snows and ice filled each vale and hollow. The result of this history was the movement of large masses of rocks and drifts down the hill slopes, and the transportation of those masses for long distances along the hill faces and along the vales of the district to which they belong.

One characteristic, however, marks such travelled masses. They are always local, that is to say they never cross a valley or are transported over a hill platform. They are generally angular masses, or only rubbed on one side. These drifts are the results not of marine agency, or of glaciers, as is generally understood of glacier transportation of rocks, but of perennial snow and ice which once sheeted over the greater part of England all the autumn and winter months, but has now, happily, disappeared under a more genial climate and warmer temperature.

Much has been said and written lately about the evidence of the action of the sea among these beautiful hills of Wales. Believe me, as an old student of these phenomena, when I say that there is no greater mistake than to attribute the principal drift phenomena you see in this country to the action of the sea. The drifts of this district are, with very few exceptions, old river and atmospheric drifts.

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Hearty applause followed the conclusion of the lecture, and the route was then taken for Harper's Quarry, the Rev. W. Jones Thomas—who some years ago called the attention of the late Professor Sedgwick to the splendid fossils then beginning to be found at this quarry—leading the party. On reaching the quarry, the eager geologists spread themselves over the rocks, and the sound of a couple of scores of hammers speedily astonished the echoes. Those of the party who were not so eager in pursuit of the far-gone past, gratified eye and mind with a survey of the very beautiful aspect of the country at present. Looking N. and N.W., they admired a fine scene of hills, varied in shape from the rounded knoll to the long Drygarn ridge, the lower hills being rich with crops, while the loftier shone brown and purple in the bright sunlight, and the rich valleys between, here and there golden with the ripened corn, gave the scene a human interest. Southward and S.E. rose the huge Epynt hills, and over them some of the loftier summits of the Black Mountain system made a fine background. For the botanists, this and other promising spots proved to be blanks, the very short time allowed rendering it impossible to examine any of the places visited. A remarkable example of *Carduus* (plume thistle) which had apparently grown up between two slabs of rock, and which had consequently extended itself laterally, forming a thin sheet some five or six inches across, was the only plant noticed at Harper's quarry.

The party then made their way across the slope of the hill to Castell Cymerda, an ancient British camp of small size, apparently a look-out, commanding a view of the Wye valley beneath, which is at that spot full of legendary interest as well as of picturesque beauty. The valley here broadens out considerably and is crossed at its broadest part by the line of the Central Wales Railway, which here points the old moral of time's changes in an impressive manner. The point where the railway crosses the turnpike-road, which here runs parallel with the Wye at no great distance from it, is known as Llech-yrhid ("the flat stone of Yrhid," a prince of olden time who fell here in battle with a North Walian invader), and in more recent yet now almost equally dim times was the last resting-place of the unfortunate Llewelyn, the last of British chiefs. Here he is recorded to have eaten the breakfast served to him on the morning of the day on which he perished. Close to this spot redolent of heroic recollections, in which (as Burke puts it) "the obscurity is a great element of the sublime," runs, as we have said, the railway for which Wales is indebted to the enterprise of Mr. Savin, one of the practical heroes of the present day; and the *genius loci* was probably somewhat startled the other day when the iron railway bridge was placed, by one well-planned operation, aloft above the Wye, near the spot where Yrhid fell and Llewelyn ate his last meal.

Passing by another quarry, the party descended to Gwernyfed, the poetically named spot where the Wye, with difficulty making its way among a group of alder-bearing islets, was said to be "eaten up by the aldera."

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The last assault of hammers was made at Gwernyfed, where *Trinucleus fimbriatus* are found, and a few specimens were now secured, with portions of *Trinucleus concentricus*, and *Ogygia Buchii*, and *O. Portlockii*. A visit was next paid to the left bank of the Wye, where it flows through a narrow gorge among rough rocks water-washed, and of a most picturesque appearance. Near this spot are some noted "salmon-catches," spots at which the bed of the river is crossed diagonally by ridges of rock, through which the waters have worn tortuous passages. Here are holes of enormous depth, with shelving edges perilous to unpractised feet, which have been excavated in the course of ages by the eddying waters, aided, no doubt, by the fragments of stone which they have brought down with them. Places so marked by nature have of course acquired a fame from superstition. In one place there is a cavity which bears the name of Rowland Gwynne's chair. Gwynne seems to have been a magician or wizard in past days, and possibly, for a consideration, performed certain diabolical rites at this spot to curse those who called for his services — for this was a heathenish practice which lingered down into mediæval times in the Principality; and the name here of the deep place in front of the chair, called "hell-hole," countenances the supposition. Some of the club had the temerity to sit in the magician's vacant chair, with what consequences time must unfold, and they must take the benefit of the deed.

Apart from the legendary lore attached to the spot, the ground is favourable to the growth of some rare plants. The globe flower (*Trollius Europæus*) grows here, and even now a rare *Allium* (*A. schænoprasum*) was plentiful, though out of flower. *Solidago virgaurea*, in its small Cambrian form, but in perfection of golden hue; the sneezewort (*Achillea ptarmica*), and a species of *Hieracium*, were also gathered here, and had time permitted probably other plants of interest might have been found, for the spot is most promising. From this gorge, which was left with reluctance, the party hastened directly to Builth, for the dinner hour was close at hand, and mine host of the Lion had a spread of substantial viands in readiness for them.

The following gentlemen and ladies took part in the proceedings of the day:—The President, Dr. Bull; Geo. Bentham, Esq., F.R.S., President of the Linnæan Society; the Rev. W. S. Symonds, President of the Malvern Field Club, and Master Reginald Symonds; Edwin Lees, Esq., F.L.S., Vice-President of the Worcester and Malvern Clubs; Professor Griffiths and Master Ernest Griffiths, Bowdon, Manchester; John Bosley, Esq., Mayor of Hereford; the Rev. W. Jones Thomas, of Llanthomas; James Rankin, Esq., Bryngwyn; Captain Fateshall, Hereford; the Rev. Thomas Woodhouse, Hay; Richard Baxter, Esq., Mrs. Baxter, and family, Welfield House; Howel Gwynne Howell, Esq., Mrs. Howell, Miss Howell, and Thomas Howell, Esq., Llanelwedd Hall; the Rev. Samuel Clark and the Rev. Andrew Johnson, Bredwardine; the Rev. Samuel Alford, Glasbury; the Rev. J. Edward Jones, the Rev. R. H. Williams, Byford; the Rev. Thomas Phillips, Dewsall; Dr. Grindrod, the Rev. H. Houseman, and Messrs. King and East,

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Malvern; the Rev. T. Bird and Mr. W. Bird, Yarkhill; H. J. Jenkins, Esq., Holmer; Captain Williams, Talgarth; Flavel Edmunds, Esq., H. C. Beddoe, Esq., John Lambe, Esq., H. C. Hurry, Esq., J. B. Nunn, Esq., R. H. P. Styles, Esq., J. B. Styles, Esq., F. Thomas, Esq., T. Curley, Esq., and E. J. Husband, Esq., Hereford; J. E. Smith, Esq., Hay; James Vaughan, Esq., J. G. Llewellin, Esq.; F. B. Harrison, Esq., W. Harrison, Esq., Louis Price, Esq., and Thos. Joseph, Esq., Builth; Mr. With, Hereford; Mr. Turner, Pauntley; Mr. James Lloyd, Kington; Mr. T. Jones, Penceirrig; Rev. D. P. Davies, Messrs. T. Powell, David Griffith, J. Jones, Prosser, and Evan Owen, Builth; and the Treasurer and Assistant Secretary, Mr. Arthur Thompson, Hereford.

The dining hall was indeed well furnished with guests. It seemed already full, when more and more arrived, until it was with considerable difficulty that seats could be found anywhere. How the waiters managed to get about was a marvel. Happily the tables, too, were well supplied with viands, and the time passed merrily. The first course of the dinner was no sooner over than the signal rapping was heard from the presidential chair, and Dr. Bull said that the time had arrived when it was necessary for him to begin the remaining business. They had some most interesting addresses to hear, and he was very anxious that there should be time for them. He hoped they would continue their dinners, and he would endeavour to make himself heard to their accompaniment of knives and forks. The club was honoured that day with the presence of the President of the Linnean Society, and he was sure it was as great a source of gratification to the members generally as it was to himself to welcome Mr. Bentham amongst them (applause). As amateurs of botany they ought to feel specially indebted to him; for had he not, in his standard work on British Botany, put a check to the minute division of species that had begun to prevail so generally, by drawing broad lines of demarkation in the several classes? Where we are puzzled to know which is which of two or three species, his Hand-book comes to our relief and tells us they are all one (laughter). He believed that when leading men in science were kind enough to attend such meetings as these, their influence for good, especially in promoting the study of natural history, was much greater than appeared upon the surface. He was also particularly pleased to see his friend Mr. Lees there. No one has had greater experience in field meetings than Mr. Lees, and to the soundness of the advice he gave at Talgarth, and he must add also, to the brilliancy of his pen, the success of the club during the present year is in great measure due (applause). It is fair now to speak of their success, for were they not putting their armour off? and he was pleased that Mr. Lees should be there to enjoy it, and to receive their acknowledgements. He was also very glad to see at this meeting Professor Griffiths from Manchester. They would remember the excellent field address which they had received so well at the Mynydd Troed (applause). It was the first of this year, and Professor Griffiths had so kindly taken the trouble to write it, that he was glad to show

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him the gratitude which first favours always excite, and he trusted that it was not the last time they should see him at the meetings of the club (applause). He was very pleased to see at the meeting also the Mayor of Hereford (great applause). Having invaded the Principality in such goodly numbers to day, it might have been a source of satisfaction to the Cymri, if they had thought of it, (laughter) to know that they had brought their chief magistrate with them as an emblem of peace and justice, and above all of good fellowship (great applause). There was another gentleman he had yet to name, and no doubt they had all been wondering why he had not named him before, the Rev. W. S. Symonds, the lecturer for the day (applause). The fact was he did not quite like to consider Mr. Symonds as a stranger to the club. In the early days of its formation he was its life and spirit, but when he established his own club, at Malvern, and deserted the Woolhope Club, it was almost annihilated. However, the Woolhope Club had survived it, and was glad now to welcome him whenever he came to the meetings (applause). It was always the aim of professional people, great singers or actors, if they could not be placed first on the programme, to have their names put last of all, in great capitals (laughter). Though he had named Mr. Symonds last, he hoped that he would consider that he had done so in great capitals (much laughter), and he would make them more prominent if he pleased, by giving them his own university colour, the dark-blue (laughter). It did not much signify, however, in what type Mr. Symonds's name appeared in the programme of a field meeting. If it was there at all, and if Mr. Symonds was in the van, as he was to-day, the meeting was certain to be successful (applause). His enthusiasm cannot fail to impart itself to others, while his great learning in geology, and the happy knack he has of conveying information in clear and forcible language, make his lectures at once attractive and full of instruction (applause). To one and all of these gentlemen he begged to give the thanks of the club for the honour they had done it by coming to the present meeting (applause). He had now to come to this particular day. When Builth was chosen for this visit, if any one member rejoiced more heartily than another, it was the gentleman on his right hand, the Rev. W. Jones Thomas (applause). He did all he could to persuade them to come, and they must have all felt to-day that he had done all he could when they were here, to make the visit agreeable to them. Indeed, with such a cordial reception, in a district so full of scientific interest, surrounded by such beautiful scenery, and with such charming weather, it would be strange indeed if they had not all enjoyed themselves that day (applause). Mr. Jones Thomas had been so anxious that they should see the district well that he had laid out too long a route for them. He really wished the club could have walked over Carneddau to Craigddu, as Mr. Lees and he himself had done yesterday evening. It was a beautiful walk, and as to the bog on the top, if the botanists had once got there he should never have got them away in any reasonable time (laughter). He was sure they would wish him to present to Mr. Jones Thomas the hearty thanks of all

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the members and visitors present (applause). Besides his own personal exertions for their entertainment, he deserved their thanks also for recommending to them such an excellent first lieutenant,—(laughter,)—such a capital conductor as Mr. David Griffith had proved himself to be (applause). Mr. Griffith had spared no effort to oblige them, and had done so with a readiness and enthusiasm which could not be surpassed, and indeed which could only have sprung from a real love of science. He begged also to give to Mr. Griffith the thanks of the club for the trouble he had taken (applause).

The President said he had only then to add that Mr. Griffith, Mr. Powell, and Mr. Turner had provided selections of the best fossils of the district, and would hand them round the tables in the course of the evening for their inspection. Mr. James Lloyd, of Kington, has also brought a couple of crossbills *(Loxia curvirostra)*, or German parrot, as this bird is sometimes called, which had lately been killed near Kington, to show them. These birds were shot near Kington the first week in this month, and at the same time a young bird was also killed, proving that they had bred in this county.

The specimens of fossils exhibited were so fine and rare as to demand some more special notice. On each tray a very fine *Ogygia Buchii* was shown, all of them being found at Harper's quarry, on the Wellfield estate, where this trilobite is very abundant, but it is also found at several other places in the neighbourhood—Gwernyfed, Cwmhenllan, Pencerrig, &c. Those found at Harper's quarry, however, Professor Sedgewick says he could distinguish from a box full of others. On one tray there were some fair specimens of *Ogygia Portlockii*, and *Agnostus M'Coyii*, from the Pencerrig quarry. One *Trinucleus fimbriatus*, found at Gilwern-hill, near Llandrindod, was very much admired, as was also one magnificent specimen of the *Ogygia corndensis*, found by Mr. Turner on the same hill. This fossil is found in great abundance at one particular spot, so much so, that every handful of stone drawn out will hold a considerable number of specimens. On this same hill was found one of the *Trinucleus concentricus* that was exhibited, the other being from Cwm-henllan, as was also a very fine *Trinucleus Lloydii*, with the fringe and spines very clearly marked. But speaking of spines, one *Ampyx nudus* was exhibited with a spine nearly two inches long.

From the Llandovery beds we observed one very good *Pentamerus oblongus*, but these beds are but very indifferently developed in this district. From the Wenlock shale were exhibited some very fine and rare specimens of the *Cardiola interrupta* and *Cardiola fibrosa*, found on the banks of the Wye, about a mile eastward from the town, in close contact with the beds containing *Phacops Daviesii*. Of this latter fossil (*Phacops Daviesii*) the first specimen examined by Mr. Salter was found some years ago by one of the workmen employed in making some alteration on the turnpike road leading to Hay, and given to Mr. Griffith Davies, after which gentleman the fossil was named by Mr. Salter. From another part of the Wenlock shale, at a

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place called Cerwynddu, about half a mile west of the town, on the banks of the Irfon, some very rare specimens for this district have recently been found by Mr. David Griffith. One very large fossil, which some gentlemen supposed to be the end of an *Orthoceratite* flattened, and others a *Discina*, was marked "unknown," nor could it be defined. There was also one other marked "unknown," which was much admired. The spot where these latter fossils were found is one of the most picturesque spots in the district, well worthy of an artist's visit. About a mile and a half west of Builth, where the Central Wales Railway runs, some most interesting fossils were found, which give one some idea of the animals that formerly lived in that particular district. Two *Pterygoti* only, a fair number of *Ptilodyctia lanceolata*, and an immense number of *Orthoceratites*, have been found on this line. One of the *Pterygoti* is named by Mr. Salter *Pterygotus Jonesii*, and the other as "a new species." Mr. David Griffith was fortunate enough to find both these specimens. There was a specimen of *Graptolites iudensis*, the second ever found in this district, from the Volcanic grit, on the tray, which Mr. John Jones, of Builth, handed round for inspection. In the Llandilo flag, the best *Calymene duplicata* was handed for inspection by Mr. Powell, as was also a very fine *Homalonotus Knightii*, found near Erwd village in the Upper Ludlow, and one specimen only of the *Spongarium Edwardsii*, a very rare fossil indeed. There were numerous other different specimens exhibited, but space and time prevents our being able to do justice to them.

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HEREFORDSHIRE YEW TREES.

BY THE REV. THOS. WOODHOUSE, M.A.

Among the trees and plants which some botanists have been disposed to strike out of our Native Flora occurs the Yew. I own I demur very strongly to such an opinion. If there is one tree more than another which seems to me distinctively and characteristically British, it is the Yew. Even the Oak does not seem to me more decidedly our own.

By an introduced plant, I understand one introduced within historical times. It does not follow that because a plant is rare in Britain, and common on the Continent, it is therefore not a native. It may date from the times before history began, when, under widely different circumstances of climate and elevation, Britain was not the separate island it is now. We cannot expect our own island to have a Flora and Fauna peculiarly its own: and it seems to me unreasonable to assume that a plant is not a native unless we know the date of its introduction, or the person who brought it here.

If introduced at all, the Yew must, I think, have been introduced by the Romans. The age of some trees, now standing, carries us back beyond the Norman Conquest; indeed, in one instance recorded by Evelyn, the tree must have dated from a far more remote antiquity — almost from Roman times. But the Romans are by no means likely to have introduced the Yew. They regarded it with horror and aversion; they associated with it images of gloom and terror; they supposed its fruit to be poisonous; and its very shadow to be fatal to those who lay beneath it. And it is hardly credible that they should have planted in their gardens, as an ornament, a tree which filled them with so much dread.

The Yew occurs in many places where one can hardly suppose it to have been planted; where it must at least have been self-sown, if not indigenous. Thus it is found growing out of rocky banks near the summit of many of our steepest woods, especially where a harder stratum intervenes between softer ones and projects below the general outline. The situations of this kind in Herefordshire, where the Yew occurs, are so numerous and so widely dispersed, that we must suppose our forefathers to have been much more diligent planters than we have any other reason to think they were, if we owe to them all these picturesque spots of evergreen foliage and gnarled and knotted roots.

My own belief is that the Yew is strictly indigenous, and widely dispersed through this county, though nowhere very abundant.

Our finest Yews are, without exception, to be found in old churchyards.

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There they seem to be contemporaneous with some of the very eldest churches, and planted to correspond with the plan of the building. I mention this circumstance, because an eminent honorary member of ours a short time since started the notion that, instead of the trees being planted to correspond with the church, the church was placed to correspond with the trees. Now I know at least two Norman churches which have four Yew trees planted at nearly regular distances from the four corners of the building, N.E., S.E., N.W., S.W. Such a coincidence surely cannot be accidental, and it would be wonderful indeed if four indigenous and self-sown trees placed themselves with such precision as to guide the architect.

Let us suppose the church built, why should not the Yew trees be planted for ornament? Our forefathers had no such prejudice against the Yew as the Romans had; they had no variety of evergreens to choose from; they had, in fact, no other evergreen that could be called a tree: for the Scotch fir never seems to have been indigenous in the South; the box, the holly, and the juniper, were all too small to give shelter, though they did aid, and were used to aid, in giving ornament. We are so accustomed to pines and firs, cypresses and cedars, and arbor-vitæs, laurels and bays, and all the other multitude of evergreens, which have added so immensely to the resources of our country as well as to the beauty of our gardens, that we are apt to forget that our forefathers had *none* of these; that the best known and most widely spread of them are younger than an oak or a yew of 300, or even 200 years old.

The Yew was an ornament not only to the churchyard, but to the church itself. Its foliage, together with that of the box, was as much appropriated to Easter as holly and ivy were to Christmas: and in some old churches in this county the custom still lingers on, or did till lately, of decking the church at Easter with sprigs of yew and box. It is worth noting that both those trees are then in flower, so that the appropriateness of the emblem to the season is very striking.

It is said that boughs of Yew were formerly employed in the services of the day on Palm Sunday, instead of real palms. If this were so, it is another reason why the tree should be planted near the church.

It may be reasonably supposed that Yew trees were formerly much more numerous in this county than they are at present, and that the reason why the oldest yews are now found in churchyards is that that was the only place where they were spared. Everywhere else yew trees fell before the woodman's axe. The demand for yew wood for bows was so great, and lasted so long, that we may be certain every corner of the country was ransacked for the precious material—for precious it was. English archers turned the scale in many a well-fought field: and the Yew was the only wood of which their bows were made. An extensive trade in yew soon sprang up, and was carried on

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throughout the middle ages, until the introduction of fire-arms caused its gradual extinction.

When more peaceful times came in the Yew was turned to another use.

> Retired leisure,
> That in trim gardens takes his pleasure,

began to plant yew hedges, such as Evelyn and Bacon delighted in, such as we have still a noble example of in the gardens at Holm Lacy. Soon afterwards sprang up the strange taste for what in those days was called the "topiary art," i.e., the art of clipping trees into all sorts of curious and unnatural shapes. The yew lent itself to this purpose admirably; it bears clipping better than perhaps any other tree; it is not liable to lose branches, as the laurel does, and there is no part of the year at which it looks really shabby. The gardeners of the age of William III. and Anne revelled in the wonders their shears produced: obelisks and pyramids, dragons and peacocks, and, if we may trust the humourists of the day, even human figures and historic scenes. The taste still lingers in our cottage gardens; and we may still occasionally see a yew putting on the semblance of a column or a pyramid, or scooped out into a little arbour, sacred to spiders and earwigs, or—triumph of artistic skill!—shooting up into a peacock, with no legs, and with a head which shows a strong inclination to spread out in rivalry of its tail.

It remains that we should notice the size and situation of some of the most remarkable trees in this district. The list will be but brief and imperfect; but it contains some trees which would be remarkable anywhere, both for size and beauty, and it shows how generally they are dispersed over the whole district. I feel persuaded that further search would very considerably extend the list. But search is necessary, for it is chiefly in the more remote and secluded spots that the finest trees are found. The hand of the improver has spared them most in such places, and allowed their native luxuriance to have fair play. I proceed to notice a few of the largest of them.

It does not appear that we have any of those giants which are spoken of in Kent and Sussex. The largest I know of in the county is at Peterchurch: this is 28 feet in girth, and 66 feet in the spread of its branches from side to side. The trunk of this is partially hollow, and the ends of some of the branches dying, but it is still a noble tree. And here I must be allowed to mention that in measuring the girth of a yew tree it is impossible to fix any definite height above the ground for doing so. We must measure a yew tree where we can, and this for an obvious reason. The trunk of the yew, unlike that of any other large tree, is frequently, indeed generally, so thickly covered with small stiff twigs, that there is no chance of getting through them down to the tree itself, and a spot must be found where this obstacle does not occur.

The next largest Yew tree is not exactly in the county, though very little outside the boundary. It stands in Bockleton Churchyard. Its girth

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THE REMARKABLE TREES
OF
HEREFORDSHIRE.

THE WESTERN YEW TREES, LEINTHALL STARKES.

(Taxus baccata, fœm.)

APRIL, 1867.

These fine old trees are much more lofty than the Church of Long Leinthall, which they shelter. Tradition states that the bell was formerly hung on the tree in the foreground, albeit the bell turret, which it completely hides in the picture, is itself very ancient. The card (1ft. by 6in.) is placed at five feet from the ground. The circumference of the trunk at this spot, where it is clear and solid, is 17ft. At the ground level it is 16ft.

The largest tree is on the eastern side, and this, with a clear solid bole, measures 20ft. 6in. at 5ft. from the ground.

(Ladmore, Photographer to the Woolhope Naturalists' Field Club.)

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at 5 feet from the ground is 24 feet 6 inches, and at 3 feet from the ground 25 feet 5 inches. On the E. side the branches spread 29 feet from the trunk, and on the W. 34 feet.

Next comes the old tree at Yazor, which lost one of its largest boughs about five years ago. This is 22 feet in girth at 3 feet from the ground.

One of the four magnificent trees in the churchyard at Leinthall, between Wigmore and Ludlow, measures 20 feet in girth, and the smallest 15. The spot is well worth a visit. The church is very small and very old. It stands in a secluded spot at a little distance from the village and from the road. Two yew trees stand at the W. and two at the E. of the church, far surpassing the bell turret in height, and all but hiding it from view. The huge spreading branches rival those of the cedar in their graceful sweep, and are interlaced with each other in the most curious and intricate manner.

Four trees, as fine as those at Leinthall, stand in the churchyard at Cusop, near Hay, not above a mile from the station which we passed this morning. They stand N.E., S.E., N.W., and S.W. of the church, but not at the same precise distance from the church and from each other which the trees at Leinthall do. The largest of the four is the one at the S.E. corner of the church, and measures 21ft. 2in. in girth at 3ft. from the ground. Above that the bole expands, and at 4ft. it measures 22ft. 10in. The trunk of this tree is perfectly sound and solid, and free from the stiff bristling twigs which disfigure those of so many trees, and make accurate measurements of them all but impossible. That to the S.W. of the church, near the porch, is perhaps even larger, and decidedly more picturesque and luxuriant. It is a sound and vigorous tree, measuring at 3ft. from the ground 20ft. 8in. in girth, and at 4ft. considerably more. The branches spread in one direction 26ft. outwards from the trunk. Assuming the calculation to be correct, which assigns a century for every foot in diameter of the trunk of a yew tree, neither of these trees can be less than 700 years old; and it is interesting to notice that this carries us back to about the same date at which the church appears to have been built.

In fact, it is chiefly in the oldest and most secluded church-yards, such as this, that the finest yew-trees are to be found. Perhaps, as they appear to have been in this case, and in that of Leinthall, they were planted when the church was built; perhaps it is only that the trees have been allowed to remain, because the church itself has been little altered, and the neighbourhood has undergone but few changes, and so, both church and trees have escaped by reason of their obscurity.

I have memoranda of about twenty other trees in a paper, which will be laid before you. The details of so many measurements would be dry and uninteresting: a visit to the trees themselves would hardly ever be so. Most of them are picturesque objects in themselves; many of them stand in the midst of striking scenery or picturesque and curious buildings. The good taste,

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which led our forefathers to plant the trees seems in many instances to have chosen the best positions for doing so.

It only remains for me now to tender my best thanks to those friends who have so kindly assisted me in obtaining these measurements :—

	Locality.	Girth.	Spread of Branches.	Date.	Remarks.
1.	Cusop, churchyard, N.E. of ch.	10ft. 10 in.	19ft. 0in. to N. W.	1866	The smallest of the four great trees.
2.	Credenhill, roadside	11 1	10 4	1866	Growing out of a hedgerow.
3.	Ashen, churchyard	19 1		1866	Hedgerow and gave the road.
4.	Credenhill, roadside	12 8		1866	Close to No. 2.
5.	Eardisley, churchyard	14 9	15 2	1866	One out of several.
6.	Brotwardine, churchyard	14 7		1866	A tall, vigorous tree.
7.	Lelnthall Earls, churchyard	15 0	21 0 to N. ...4.	1866	One of four great trees, sound and vigorous.
8.	Eaton Bishop, churchyard	15 9		1864	Hollow.
9.	Credenhill, roadside	15 2	14 11	1866	With Nos. 2 and 4.
10.	Brinsop, churchyard	15 4	16 1	1866	
11.	Lelnthall Earls, churchyard.	16 0	27 0 to S.	1866	Leaning—S.W. angle of church.
12.	Ditto ditto	16 0	30 0 to E.	1866	Upright & vigorous—N.E. angle of church.
13	Credenhill, roadside	17 8	23 1	1866	With Nos. 2, 4, and 9.
14.	Cusop, churchyard	17 10	18 0 to S.	1866	A very fine stately tree—N.W. of church.
15.	Breinton, churchyard	18 0		1864	Past its prime, but healthy.
16.	Croft Castle grounds	19 6		1864	An old stump, with short shoots.
17.	Burghill, churchyard	17 6	20 8	1866	
18.	Lelnthall Earls, churchyard	20 0	30 0 to S.	1866	Splendid tree; sound & upright; S. of ch.
19.	Cusop, churchyard	24 7 at 4 ft. 6 in. / 21 2 at 3 ft. / 22 10 at 4 ft.	26 0 to E.	1866	Sound, healthy tree—S. W. of church.
20	Ditto ditto	19 3	30 7	1866	The finest of the four—S.E. of church.
21.	Foxley	22 0		1866	Very hollow, and much shattered.
22.	Yazor, churchyard	24 6 at 5 ft. / 25 5 at 3 ft. / 23 0 at 3 ft.	29 0 to E 34 to W.	1866	Partially hollow.
23.	Brockleton, churchyard	15 9	66 from side to side	1866	Partially hollow.
24.	Peterchurch, churchyard	15 3		1866	
25.	Ditto ditto	18 0		1866	
26.	Ditto ditto	20 0	13 0	1866	
27.	Weston-under-Penyard	18 0	19 0	1866	
28.	Kingston Court, ditto	11 0	22 0	1866	
29.	Wharton Court, ditto				
30.					

The paper was received with great applause.

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which led our forefathers to plant the trees seems in many instances to have chosen the best positions for doing so.

It only remains for me now to tender my best thanks to those friends who have so kindly assisted me in obtaining these measurements :—

	Locality.	Girth.	Spread of Branches.	Date.	Remarks.
1.	Chasop, churchyard, N.E. of ch.	10ft. 10 in.	19ft. 0in. to N. W.	1866	The smallest of the four great trees.
2.	Credenhill, roadside	11 1	.....	1866	Growing out of a hedgerow.
3.	Aston, churchyard	12 0	10 4	1866	Hedgerow above the road.
4.	Credenhill, roadside	12 8	.....	1866	Close to No. 2.
5.	Eardisley, churchyard	14 0	15 2	1866	One out of several.
6.	Eardisland, churchyard	14 7	.....	1866	A tall, vigorous tree.
7.	Letchhall Earls, churchyard	15 7	21 0 to N.	1866	One of four great trees, sound and vigorous.
8.	Eaton Bishop churchyard	15 9	.....	1866	Hollow.
9.	Credenhill, roadside	15 2	14 11	1866	With Nos. 2 and 4.
10.	Brinsop churchyard	15 4	.....	1866	
11.	Letchhall Earls, churchyard, ditto	16 0	16 1	1866	Leaning—S.W. angle of church.
12.	Ditto	16 0	27 0 to S.	1866	Upright & vigorous—N.E. angle of church.
13.	Credenhill, roadside	17 8	30 0 to E.	1866	
14.	Clasop, churchyard	17 10	23 1	1866	With Nos. 2, 4, and 9.
15.	Brinton, churchyard	18 0	13 0 to S.	1866	A very fine stately tree—N.W. of church.
16.	Croft Castle grounds	19 6	.....	1866	Past its prime, but healthy.
17.	Burghill churchyard	17 6	.....	1864	An old stump, with short shoots.
18.	Letchhall Earls, churchyard	20 0	20 8	1866	
19.	Clasop, churchyard	{20 8 at 3 ft. 24 7 at 4 ft. 21 2 at 3 ft. 22 10 at 4 ft.}	26 0 to E.	1866	Splendid tree; sound & upright; S. of ch.
20	Ditto ditto	.....		1866	Sound, healthy tree—S.W. of church.
21.	Foxley	19 3	.....	1866	The finest of the four—S.E. of church.
22.	Yazor, churchyard	22 0	30 7	1866	
23.	Brockleton, churchyard	{24 6 at 5 ft. 25 5 at 3 ft. 28 0 at 3 ft.}	29 0 to E. 34 to W.	1866	Very hollow, and much shattered.
24.	Peterchurch, churchyard	15 9	66 from side to side	1866	Partially hollow.
25.	Clifford churchyard	.....		1866	Partially hollow.
26.	Ditto ditto	15 3	.....	1866	
27.	Ditto ditto	18 0	.....	1866	
28.	Weston-under-Penyard	20 0	13 0	1866	
29.	Kingston Court, ditto	18 0	19 0	1866	
30.	Wharton Court, ditto	11 0	22 0	1866	

The paper was received with great applause.

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THE REMARKABLE TREES
OF
HEREFORDSHIRE.

THE YEW TREE AT PETERCHURCH.

(Taxus baccata, fœm.)

MARCH, 1867.

This ancient tree has withstood many a storm from the Black Mountains, and has lost in the struggle most of its principal branches on the North and East side. The circumference of the tree at 5ft., where the card of the Club is placed, is 28ft., but nearer the ground, just above the seat fixed round the stem, the circumference is 19ft. 6in. The stem is partially hollow, and filled up with stones.

(Ladmore, Photographer to the Woolhope Naturalists' Field Club.)

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Mr. BENTHAM being called upon by the Chairman to address the meeting, said that he had listened to the paper of Mr. Woodhouse with much pleasure. He, however, could not subscribe to the proposition that the Yew is indigenous. The seeds of that as well as of many other trees were easily transported by the wind or by birds, and were thus plentifully sown; and when the seeds found suitable conditions of soil and moisture, as in Herefordshire, they germinated freely. Then, too, it must be remembered that in early times the wood of the Yew was found to be useful for bows as well as for various domestic purposes, so that it became profitable to plant and cultivate it. Upon full considerations of the evidence that had been brought forward on both sides, he had been induced to come to a conclusion different from that which Mr. Woodhouse had arrived, viz., that upon the whole the probabilities were against the Yew being indigenous. If, indeed, there were any proof that the Yew was in the country during the Roman occupation, that would have been, as stated by Mr. Woodhouse, a strong argument in favour of his position; but he (Mr. Bentham) was not aware that there were any facts, historical or other, warranting that supposition. We have no doubt yew-trees which, from their appearance, date probably from Saxon times, but there are no means of ascertaining the real age of our oldest trees. Even if they were cut down, as the interior has generally been long since destroyed by decay, the number of annual rings, the only unerring test of the age of trees, cannot now be counted. Nothing is more fallacious than judging of the age of trees by the diameter of their trunk, as is shown, for instance, by the error into which even De Candolle has fallen in the immense age which he had ascribed to the Baobabs of tropical Africa, or by the mistakes of modern lecturers on the gigantic Wellingtonia, to which an age of three to four thousand years had been ascribed, whereas one of the largest, when cut down, showed only 1,400 years in the whole, and showed also that the increase in diameter had been very irregular—rapid in the first three or four centuries, then much slower for three or four centuries more, then increasing again for three or four centuries before it dwindled down to the slow growth of age (applause).

Mr. E. LEES said that there was one remarkable point in the physiology of the Yew which the writer of the paper they had just heard had not attended to, though it was a most important circumstance to illustrate, and that was its imperishability. By the laws of vegetable life as exemplified in the yew-tree, there was no limit to its duration, and trees might be now in existence so old as to be beyond historical data. He had before said, and he still affirmed, that though the Yew had been brought into connection with the rites of the Church as the emblem of immortality in the west, as the cypress was in the east, yet in numerous places the Church had been brought to the Yew, and not the Yew to the Church. The circumstance of yews being already growing on a convenient and perhaps previously venerated spot had induced the erection of a church by the first Christians. He could adduce numerous

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instances where the Yew in the church-yard was evidently older than the structure near which it stood, but he would now only adduce to a Herefordshire Club the yews in Cradley church-yard, near Malvern, because both of these were hollow and of great size (the largest 26 feet in girth), and one of them exhibited that conformation proving an extreme old age that could not be ascertained by rings of annual growth. (Mr. Lees here exhibited drawings in illustration of his remarks.) The Yew tree grew in the same manner as other dicotyledonous trees, and a section taken of any undecayed bole would show its age by the number of rings of annual growth visible, and thus by taking the average bulk of a hundred years' growth the age of various Yews had been calculated. But the bole of a Yew was subject to decay, like those of other trees, and in the course of centuries the long-deposited heart-wood decayed and became lifeless, but still vegetative life slowly progressed, till at last, as in one of the Cradley yews, there was presented the singular appearance of the brown and dried mummy of the original tree, encased within a subsequent deposition of alburnum or new wood, supplied from above. In this case, then, the age of the tree could only be shown to be very great, if not beyond computation. The process of the yew's renewal seemed to be this:—When the bole had become so decayed that the sap could scarcely circulate, from its decrepid state, the branches yet young and vigorous were enabled to pour the alburnum downwards, which by degrees descending year after year, at length encompassed the entire bole, and passed into the earth to form fresh roots for the resuscitated bole. This process might proceed to an unlimited extent, and the enduring yew be re-cased again and again, preserving its identity, if in a somewhat altered form. The Yew has been preserved in churchyards not because it was wanted for the bows of the archers of former days, but for its use in the rites of the church, in proof of which Caxton's "Directions for keeping Feasts all the Year" might be referred to, in which he says, "We tak ewe instede of palme and olyve, and beren about in procession." This was done particularly on Palm Sunday, and some country churches are decorated with yew branches on that Sunday even now. The fact was that, though the rural bowmen might take the boughs of English yew for their bows, the trained archers of our Plantagenet monarchs, who were so "dreadful with the bended yew," and with it won the victories of Cressy and Poictiers, preferred foreign yew for their bow staves, which was considered much the best, and required to be well seasoned. There was a statute passed in the 12th of Edward IV. which required that every merchant trader should bring so many bow-staves for every ton of merchandize "imported from Venice or other places from whence they had heretofore been procured." This statute was renewed in the reign of Queen Elizabeth, from which it was clear that the foreign supply was chiefly looked to for military service, and the native Yew only supplied ordinary bows for deer killing, which could not lead to any great destruction of the tree, as supposed by Mr. Woodhouse. Mr. Lees, in conclusion, contended that the ecclesiastical Yews now enclosed and

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preserved in churchyards, and venerable from long antiquity, had in many instances waved their mournful foliage as native trees long before the churches that now stand near them were erected (applause).

Mr. FLAVELL EDMUNDS was next called upon by the Chairman, and began by expressing the interest with which he had listened to the valuable paper by the Rev. Mr. Woodhouse, to whom he felt that they were greatly indebted. He thought, too, that he was only expressing the sentiments of all present when he said that they had been much gratified by the presence and the remarks of Mr. Bentham, to whom all botanists felt a debt of gratitude for his valuable works. As for his old friend Mr. Lees, of Worcester, he had long been known and esteemed by them all for his excellent contributions to the study of the natural sciences generally. For his own part he would say that, being no longer a young man, he felt so far released from the law of modesty as to be at liberty to say that he ventured to differ from all three of their friends (laughter). Those who knew his friend Lees and himself would not be under any apprehension as to the results, as they two had been accustomed to fight when they met, but as they always fought without quarrelling there was not much harm done on either side (laughter and applause). He ventured to say, too, that with all his sense of their debt as botanists to Mr. Bentham he felt at liberty to question one opinion which that gentleman had advanced. He understood Mr. Bentham to hold that the Yew is not indigenous, and that its presence in Herefordshire and other districts may be accounted for either by the usefulness of the tree, or by the ease with which the seeds may be sown by the birds. Now he disputed this proposition. If they took the philological argument, it was dead against Mr. Bentham's view. Nearly every tree which we know to have been introduced to this country brought its name with it, which has been handed down to us, more or less modified in its adoption into the English language, but still perfectly recognisable. Thus the *cerasus*, the *populus*, the *laurus*, and the *buxus*, survive as the cherry, the poplar, the laurel, and the box. The Yew, however, retains its British name *yw*, equivalent to the Greek *ἀεὶ ὤν* and the Gothic *aye*, and meaning *ever present* or *ever living* ("hear, hear," from Mr. Lees and Prof. Griffiths). The Saxons, too, called the tree by the name *iw*, a word which, like the German *eibe* (quasi *ewig leben*), also means always living. This identity of idea suggests the hypothesis that both the Celtic and the Teutonic races found the tree in Germany and Britain when they came, and were struck with its persistent greenness, when all vegetation around it had put on the red-brown robe of autumn or stood bare amid the frosts of winter. The Latin and Greek names of the Yew, on the other hand, belong to a totally different class of ideas. The Latin word *taxus* is not only diverse in its form and derivation from the British and German words, but it is one which has arisen not from the appearance of the tree but from the domestic uses to which, when cut down, the wood was applied. Dice were made from it; and the diminutive *taxillus* signified a pile driven

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into the ground, for which the hardness of the wood, and its power of resisting the action of the water, qualities which have been made available by men in all ages, pointed out the yew-tree as specially adapted. The Greeks being a more elegant-minded and less practical people than the Romans, gave the Yew a name arising out of its use for purposes of adornment. The word σμίλαξ (from σμάω, I adorn) is an allusion to the use of yew branches as funereal decorations. The contrast is instructive in an ethnological point of view, although he alluded to it merely as part of the argument that the Yew is indigenous. Some words of four letters, and all of less than that number, he had been accustomed to consider primitive words; and if that view were correct, the word *yw*, being composed of only two letters, was not likely to have been formed in any but very early times. So far from the Romans having introduced the Yew, he suspected that they found the tree here when they came. The argument from analogy supports this view. It is not denied that the Irish yew is indigenous to our neighbour island, and Mr. Edmunds said he knew no reason why the other species should not be indigenous to this country, Then again, he argued that the proposition that our yew-trees are the result of planting for use is not borne out by observation. The Yew is abundant in places far from the dwellings of men, as well as in their midst, but is chiefly to be found associated with their burial places. Between bird-sown trees, of which the introduction is not proved, and those which are indigenous, the speaker confessed himself unable to draw a distinction. He had found, however, the yew growing just outside the walls of Roman cities, and on the slopes of Roman camps, where no doubt the dead were buried—Magna Castra, the slopes of Credenhill, Acornbury, Dinedor, &c., are examples—and the Greek name of the tree, as he had shown, indicated the great antiquity of its connection with the rites of sepulture. It was quite true, as their friend Lees had said, that an Act of Parliament required merchants to import foreign yew-staves—four staves with every ton of goods; but he disputed their friend's inference that the English archer gained his great victories with foreign yew-staves. The law as to importations certainly showed that the home-grown supply of Yew was insufficient, but it showed that home-grown yew was used. Then, too, it should be remembered that an Act of Henry VII. required churchwardens to plant yew-trees in all the church-yards, the preamble reciting as reasons for the enactment the insufficiency of the supply of wood for bows, and the consequent neglect of archery. No doubt many of the existing yew-trees in church-yards are the result of that Act, but in many cases the size of the tree renders that view inadmissible. For his own part, he fully subscribed to the doctrine of Mr. Lees that in most cases the church had come to the Yew and not the Yew to the church. He put the case thus: The British word *Llan* meant originally —as shown in the words Ber-llan, corph-lan, &c.—an enclosure for any purpose; but the practice of taking possession of heathen sacred enclosures for Christian churches gradually restricted the meaning of the word until it came

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to mean a churchyard only. The yews were there on account of the sacredness of the spot to heathen ideas; the cross was set up there as a trophy of conquest; and in due course a Christian church arose in the citadel thus supposed to have been wrested from the demons of heathenism. The Yew was believed to counteract the bite of the serpent, and both the serpent and the yew it should be remembered bore important parts in the Druidical system. By way of addition to the list of remarkable yews given in the essay, he would just mention the fine grove of yews leading up to the south door of Burghill church. From inquiries, he had found that these latter trees are about 150 years old. They are about the thickness of a man's body; and he had found that fact useful in estimating the ages of other trees. The great durability of the wood, when "converted," is shown by the excellent state of preservation in which the yew beams dug up at Nineveh by Mr. Layard were found, and in the equally remarkable state of the yew timber forming part of the submerged lake dwellings of Moosseedorf, in the Canton Berne. There are some important questions about the tree while living which he had hoped to hear discussed. Virgil says, *si fugiant examina taxos;* and it would be interesting to know whether the bees still avoid the yew flower, because it is admitted that that is the only part of the tree which is *not* poisonous. Again, he should like to hear some member explain the chemical reason for the poisonous operation of yew leaves upon animals, and whether the poison affects all animals or only certain genera or species.

The Rev. Mr. JONES, as the representative of the Monmouthshire Yew trees, expressed his concurrence with the views of the writer of the paper.

The discussion then dropped, and the following paper was read.

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ON THE OCCURRENCE OF A LOCAL DEPOSIT OF PEAT WITH SHELL MARL AT HEREFORD.

BY T. CURLEY, ESQ., C.E.

In cutting a deep trench for the Widemarsh sewerage through the Stonebow meadow (a field of Mr. Bonner's), below the Barr's Court station, at Hereford, a section of a remarkable bed of peat was made, which on close examination proved to be of a very interesting character. I told our energetic President of the discovery, and he very kindly at once arranged to visit the spot with the Rev. P. B. Brodie and Mr. Thompson. The three made a more careful examination of the section, and obtained the specimens which I now show you. The surface soil was about a foot deep and consisted chiefly of rubbish, earth, and stones, with a few recent bones mixed in it. Below this was a stratum, three feet thick, of pure brick earth, of fine quality, without stones or pebbles, and extending all across the field. Below the brick clay was the peat bed, which was also continued across the whole meadow, and for a distance of at least a hundred yards averaged full 3 feet in thickness. It was of a light porous character, and contained many pieces of wood in a more or less decayed condition. It seemed composed purely of decayed vegetable matter, with scarcely any admixture of earth. The only animal remains found in it was the jaw bone of a small ruminating animal, which was found within a few inches of the bottom. The marl below the peat presented a very interesting character. Its upper layers contained well-marked impressions of leaves, and indeed masses of the leaves themselves; and immediately beneath them was an abundance of fresh water shells in layers, from the large Swan Anodon, which was very abundant in some places, to the smaller varieties of *Limnea*, so common in our ponds and rivers. This shell marl was seven feet below the surface, and itself—with a depth of about two feet—rests upon the Old Red Sandstone, as I have shown in my geological sections published in the map of the city.

We collected many varieties of shells, some of which Mr. Brodie kindly took away with him to examine more minutely. From his information and from my own inquiries, the following species were distinctly recognised:—The swan anodon *(Anadonta cygnea)*, the river mussel, or painter's unio *(Unio pictorum)*, the tentacled bithynia *(Bithnia tentaculata)*, the marsh snail *(Paludina vivipara)*, the fish-pond valvata *(Valvata piscinalis)*, the river neritina *(Nerita fluviatilis)*, the horny cyclas *(Cyclas cornea)*, with several varieties of the *Planorbis*, *Limnea*, and *Helix*, which now abound in our fresh water ponds and lakes. The impressions of leaves were very distinct, as seen by the specimens exhibited. Mr. Lees thinks them to be varieties of the willow.

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The jaw-bone with its teeth—now presented for your inspection—created some little discussion as to the animal to which it belonged, owing to its intermediate size between the lesser and larger rodents. It seemed to belong to the roe-deer, but there was much doubt on the point. My friend, Mr. Symonds, very kindly sent it to the Royal College of Surgeons, and the authoritative decision there pronounced is, that it once belonged to a small goat.

The question as to the age of the remains is one of manifest difficulty. They are found full seven feet below the present surface, and who shall say how long the lake must have existed to form a stratum of peat three feet thick? and still more difficult would it be to guess at the time required to wash down from the hills the solid three feet of brick clay above the peat.

"This deposit," says the Rev. P. B. Brodie, "though it doubtless must have taken a considerable time to accumulate, is comparatively of a very recent date. It belongs to the post-Pliocene formations, of which we have numerous examples in this country, and more especially in Scotland. The shell marl is interesting as showing how many of our older tertiary fresh water beds were formed. If it had been still more consolidated we should have had an exact representation of certain lacustrine and fluviatile limestones, which, though local, are rich in fossils, and afford a very interesting and instructive history of the periods at which they were formed. They usually contain terrestial remains of animals and plants, and therefore give a better clue to the nature of the fauna and flora of the land, than we can obtain by the marine deposits of the same tertiary epoch."

A coloured section of the deposits was exhibited by Mr. Curley, with the jaw-bone found, and specimens of the shells and leaves.

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NOTES ON A VISIT TO THE BONE CAVERNS OF THE LESSE, IN BELGIUM.

By Sir W. GUISE, Bart., President of the Cotteswold Club, and the Rev. W. S. SYMONDS, President of the Malvern Club.

For several years there have been long discussions respecting the antiquity of the human race, and the researches of M. Boucher de Perthes, Mr. Prestwich, Sir C. Lyell, and many other geologists, palæontologists, and antiquarians of repute, are already so well known to the public, that it is almost unnecessary for me to recapitulate the large amount of evidence which has at last established the great antiquity of man as an accepted fact.

Ever since the announcement in 1859 and 1860 by our distinguished countrymen the late Dr. Falconer, Mr. Prestwich, and Mr. John Evans, of the detection of human implements associated with the bones of the great extinct mammalia in ancient river drifts, and their appreciation and acceptation of the discoveries of M. Boucher de Perthes, the President of the Cotteswold Club (Sir W. Guise) and myself have studied, in various localities, the drifts and gravels of those ancient rivers which long ages ago flowed in broad streams along the existing vales of our Severn, Avon, Wye, Usk and other rivers. We also visited many of the caves, which, in Somersetshire and Wales, contain immense quantities of the bones of the extinct animals, and here and there the implements of ancient men.

We have for some time been of opinion that many of the cavern deposits would turn out to belong to the same epoch, geologically speaking, as do the old valley gravels, and are, therefore, separated from the history of our existing rivers and their alluvia, by the lapse of untold ages. We visited the caves of Gower, which I had already seen, in company with Sir Charles Lyell, and were convinced that Lieut.-Col. Wood, the ardent explorer of the cave history of that beautiful peninsula, had himself detected flint implements under circumstances which proved the existence of man during the life time of the rhinoceros and other extinct mammalia. Again, the caves of Tenby furnished us with corroborative proofs in the collection of the Rev. Mr. Smith, of Gumfreston, and the researches of the Rev. Mr. Winwood. We also visited the celebrated Salisbury sections under the guidance of Dr. Blackmore and Mr. Brown, and made ourselves acquainted with the physical geology of the surrounding neighbourhood. On this expedition we were accompanied by our friend Mr. Reginald Yorke, who had previously studied the drift deposits of Amiens and Abbeville. We thoroughly examined the high level drifts, and the low level drifts, and the remains of the extinct animals collected by Dr. Blackmore; we saw the places from which many perfect

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implements were extracted by Mr. Brown and Dr. Blackmore with their own hands; and we all agreed with Mr. John Evans, who first described these drifts, with regard to the inevitable conclusions which must be drawn by any student of physical geology, as to the long distant period when these human implements were rudely fashioned, and afterwards drifted into their resting place, to become in future ages evidence and witnesses of the existence of God's reasoning creature, MAN.

From Salisbury we also visited Hill Head, on the shores of Southampton water, where other flint implements had been detected. Here Mr. Yorke obtained a specimen, which he presented to the museum in Jermyn-street. We also convinced ourselves that the deposits from which that flint weapon was derived were transported when the physical and climatal conditions were very different from the present, and when what is now the summit of a sea cliff was the bed of a great river, or an estuary, over which flowed waters charged with ice rafts, which melted and deposited large, drifted, angular, blocks of Tertiary sandstone and quartzite in the gravel drift which contains the implements, and which, doubtless, belongs to the same geological epoch as the old river shingles of Salisbury, which were deposited under very different circumstances to those under which the Salisbury streams now deposit their alluvia. These old rivers rolled down their courses in times when every vale was filled, and every hill and eminence was covered with snow and ice during the winter months, and when the waters rolled rapidly under every summer's sun, carrying with them the eroded quartzite masses, and the sharp, subangular, flints. And the inhabitants of the lands of those times were the old men, and the mammoth, and the woolly rhinoceros, the cave lion, the lemming, the marmot, and the Siberian hare.

It was not then without much previous preparation and study among the peculiar class of geological phenomena we wished to investigate, that we determined to proceed to Belgium, to examine the geological conditions under which the fossil remains of human beings had been found by Dr. Edouard Dupont, of Dinant, in caves, in the carboniferous limestone which rises above the river Lesse, which flows into the Meuse near Dinant, in the south of Belgium.

As my own notes are strictly confined to the geological phenomena we observed, I will here quote from the daily journal kept by Sir Wm. Guise, which he has kindly lent me, and in which descriptions and details of the scenery, as well as of the geology, are noted:—

"In July we left Brussels for Namur, in company with our friend, Mr. John Jones, formerly hon. sec. of the Cotteswold Club. From Namur we proceeded to Dinant, accompanied by Mons. Dumont, engineer *en chef* of the Province, to make the accquaintance of Dr. Dupont, who has superintended the great cave excavations made under the auspices and with funds supplied by the Belgian government. The river Lesse flows into the Meuse at a distance of about 1½ miles from Dinant. Up the valley of the Lesse our

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course lay, a narrow valley bounded by rocks of Carboniferous limestone, frequently much contorted, while their jagged and angular outlines, tell of some other force than mere erosion by water having had to do with their present abrupt configuration. The slopes are richly clothed with wood, while the river winds through a green pastoral valley, never, probably, much more than half a mile in width, and for the most part far less. We crossed the Lesse three times at fords, which were sufficiently deep to admit the water into the carriage. About 2½ miles from Dinant the road passes under the Castle of Walsin, which stands on the summit of a bold rock immediately above the stream, and presents a most picturesque appearance. Thence to the village of Challeux is about 2½ miles of execrable roads. Here we descended from our carriage and made our way to the river at this point, deep and still. A shout of recognition was exchanged, and presently a narrow flat-bottomed shallop was poled across to convey us to the opposite side of the stream, where a long talus of broken earth and stones showed where operations were being carried on. A course of steps cut in the hill side led up the slope, at the top of which we found ourselves in front of a yawning cavern, and in presence of a gentleman in the dress of an excavator. The latter was Dr. Dupont, and the cave that of *Naulette*, in which was found the now famous human jaw, associated with *Rhinoceros tichorinus* and other extinct mammalia. Dr. Dupont welcomed us with cordiality. Armed with lights, we entered the cave, from which large quantities of material had been removed. Dr. Dupont explained the characteristics and relations of the so-called "Lehm" and "Lœss." The latter he considers to be *marine*, and shows that the jaw was found in the former, under at least seven feet of "Lœss" sands. The position of this jaw has been disputed; but there were too many persons present at the time of its discovery to admit of any doubts on the subject; its exact position is determined without room for cavil. We were a queer looking set as, with wolf-skins over our shoulders to shield our coats from the wet and clay, we emerged again into the light of day.

From Naulette we proceeded to the "Trou du Frontal" and the "Trou des Nutons." By-the-way we halted at the little hamlet of Challeux, quite a little republic of its own in this remote out of the way spot. It is most pleasingly situated on the banks of the stream, embosomed among trees, and having opposite, bold limestone cliffs—in which is a bone cave called the cave of La Challeux—which in the number and variety of the remains it has yielded, is surpassed by none in the valley. Unfortunately we did not examine this cavern, being hurried on by our guides, and it was not until afterwards that we were made aware of its importance. In less than a mile the carriage again came to a halt, at the nearest approachable point to the Trou du Frontal, and the Trou des Nutons. The way lay through a dense woody jungle, in which all trace of a track was nearly obliterated. These were the first opened, and the "Trou du Frontal" received its name from the frontal or forehead bone of a human being, the first which was discovered

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in the course of these important excavations. Having read and translated the original report of Dr. Dupont on these caves, I was especially careful in their examination. The structure of the "Trou des Nutons" is particularly well shown. At base, a river gravel with rounded drift; next, the "Lehm," a fine granular deposit; then the "Loëss," consisting of stratified sands and clays, the latter of red colour, of so close and compact a structure, that they break with a conchoidal fracture, and when cut or scraped with a knife exhibit a shining surface. Over all these, and unconformably to them, lies heaped up against the side of the mountain a mass of angular debris, doubtless a subaerial drift accumulated by the slow action of atmospheric causes, and telling eloquently of the vast lapse of time during which they have bit by bit been gathering.

In returning, Symonds and some of the party scaled the limestone rocks by a precipitous track leading on the summit to the ancient Roman fortress of Hauteraiscenne, considered by M. Van Beneden to be one of the last strongholds of that people before they were driven across the Rhine. Coins of Gallienus have been found there, which seem to point to the date of its final abandonment.

After dinner, Symonds and myself went by appointment to inspect the museum of Dr. Dupont. This collection fills three rooms, and is itself such an illustration of primeval man as cannot be paralleled elsewhere, while it bears no less striking testimony to the energy and enthusiasm of the collector, who has himself personally assisted at the disentombing of every specimen. The cave of Challeux, which we unfortunately failed to visit, appears to have yielded the richest results, no less than 34,000 worked flints, the teeth of as many as 40 horses, the remains of bears *Ursus spelæus*, and *arctus*, horns of reindeer, *C. tarandus* and *C. guettardi*, in many cases showing the marks of human handiwork; bones of badger, fox, goat, water-vole, land-vole, &c., of the latter in vast quantities, all of which had been used for food. No human bones were however, so far as I could learn, found in this cave. But, without question, the most remarkable object in the collection is the human jaw, from the "*Trou de la Naulette.*" This jaw appears to be more ape-like than any yet attributed to man. Yet to *man* it is decided to belong. The bone of the chin is entirely wanting, and the canines, which are absent, were evidently very powerful, as shown by the size of the orifices for their insertion; the jaw is remarkably small, and must have pertained to a race of diminutive stature. Dr. Dupont entertains no doubt of the vast antiquity of man upon the earth. He said "The man of the Mammoth is the man of the Reindeer, and the Reindeer man is the man of the polished flint period." One fact mentioned by Dr. Dupont is exceedingly curious, namely, that the horse appears to have abounded at the time of the *early* cave men with rudely worked implements of silex, and was consumed by them for food, but that this quadruped's remains are wholly absent in the polished flint period, from which he argues that the horse was reintroduced at a later period. Amongst

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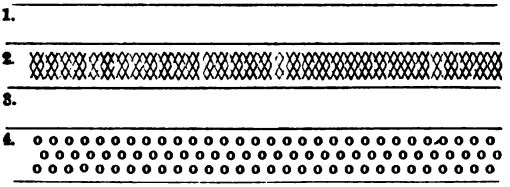
the objects found in the cave of Challeux were pieces of fluorine spar, and fossil shells, amongst them *Cerithium giganteum*, imported from the country of Champagne, distant some 40 or 50 miles. The flints, too, which were used for working were brought from the same distance, showing evident knowledge of a rude state of trade or barter.

It is to be noted that the fossil shells were pierced with small round holes, evidently to suspend them as ornaments."

Such are Sir William Guise's remarks upon these most interesting caverns and their contents. I would only add a few brief notes for the information of those physical geologists who have studied the phenomena of ancient river and cave deposits, and would be interested in our endeavours to correlate those of Belgium with our own here in England.

The following is the succession of deposits as sketched for me in my notes by Dr. Dupont:—



1. Angular debris. 2. Stalagmite. 3. "Loess," or stratified sand and clay. 4. Pebble beds *(cailloux roulés)*.

The points that struck me most particularly are as follows:—

First.—On ascending the ancient Roman encampment above the "Trou de Nutons" with M. Dumont, and Dr. Dupont, they pointed out to me the position of the *Drifts* that overlie the great platform of carboniferous limestone. These drifts contain erratic pebbles and boulders, and occupy a similar position above the bone caves on the Lesse, as do those of the boulder drifts of Gower above the caves on the sea coast, or those of St. Asaph, above the river that runs below those caverns. The rolled pebbles at the base of the cave deposits are like those on the upper limestone platform.

Secondly.—After the Belgian caverns had been hollowed out in the carboniferous limestone, and the carbonate of lime removed, probably by springs acting upon longitudinal fissures, it is very evident that either engulfed streams, or the action of waves, affected the interior of the caves precisely as was observed by Sir C. Lyell and myself in the caves of Gower and St. Asaph. Although encrusted with stalactitic matter there were numerous potholes and marks of water action.

Thirdly.—Along the valley of the Lesse there have been undoubtedly physical changes in the configuration of the district since the deposition of all the stratified deposits within the caves. This is also what we know has occurred in many instances among the subterranean caverns which contain the bones of the extinct mammalia and the flint instruments, of men in England.

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Fourthly.—It is the opinion of Dr. Dupont, if we rightly comprehended him, that the "*Loess*" which underlies the stalagmite of the caverns, and consists of stiff clay and stratified sands, the same which contained the human jaw and the bones of the *Rhinoceros tichorinus*, is of *marine origin*. I do not know what reasons Dr. Dupont has for holding this opinion, but we shall soon be made acquainted with them, as that gentleman is about to publish a work upon the physical geology, as well as the animal contents of these Belgian caves.

This is an important point, for if the basement gravel and silts in the caverns turn out to be *marine*, I see no way of escaping from the conclusion that the valley of the Lesse was submerged beneath the waters that deposited the pebble and drift beds on the summit of the limestone platform that rises above the caverns, and consequently that these cavern drifts are *pre-glacial*. We arrived at other conclusions upon which, however, I am unwilling to lay much stress, as our survey was necessarily short.

It appears from the statements I gathered from Dr. Dupont that on the flanks of the Lesse valley, above the bone caverns, but below the platform drifts, there are high level *valley gravels*, which tell of an ancient river which flowed at *a higher level* than the waters of the existing river, and which old river is not unlikely to have washed down pebbles and drifts derived through streams and lateral sources from the platform drifts on the high country around. Again, the pebble beds which lie at the base of the deposits of the "Trou des Nutons" and the "Trou de Naulette," do not appear to me to have a marine aspect, they have the arrangement of an old river shingle. My impression is that this shingle was derived from the platform drifts on the upper surface of the country, and was washed into the caverns by the agency of the under-ground streams which opened out into the valley of the ancient Lesse. This is supported by the evidence of the animal remains found in the basement deposits. Remains of the *beaver* were found by Dr. Dupont, and this testifies more of fresh water conditions than marine. Again, we believe that the "*Loess*" or stratified clay and silt which contained the human jaw and mammalian bones, is a *fluviatile silt*, the deposit of waters which once swept into or through the caves before those relative changes of land and water level were brought about, which caused the floodings by turbid waters to cease, and the floor of the caves to become dry land, and the stalagmite to gather above the human and animal relics with its encrusting seal.

Altogether we believe the history of the cavern deposits on the Lesse to belong to that *ancient river history* which geologists now comprehend as the period of the *low level drifts* of Prestwich, a period when, as we know in this country, climatal adaptations and the animals of the period were very different from the present. Since that period the great mammalia, which once inhabited Europe, have become extinct, and all our rivers, like the river Lesse, flow in deeper hollows excavated in the hard strata which forms the bottom

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of their valleys. We consider the drift phenomena of the caverns on the Lesse to bear the same relation to the existing physical conditions of the country as our old Severn and Avon, low level valley drifts, bear to the existing rivers, their silted up lakes and alluvial plains. We see no reason for attributing a more antique history to the human remains of the "Trou de Naulette," than to the numerous other examples given by Sir Charles Lyell in his "Antiquity of Man," where human bones, or human implements, have been found in cavern deposits associated with the remains of the extinct animals.

The principal interest attached to the caves on the Lesse is owing to the great numbers of human relics that have been found there; and I may here observe that the particular cave in which the very remarkable jaw was found lying close by the bones of the rhinoceros, is considered by Dr. Dupont to have been a den of the hyæna, for here were found the coprolites or fossil dung of that animal, and also a considerable number of gnawed bones of elephant and other animals. The rhinoceros bone in question presents strong marks of the hyæna's canines.

With respect to that jaw I have no opinion to give. Since I visited the caves with Sir William Guise, the Anthropological Society of London have sent a deputation to Belgium, and I cannot do better than close this paper with an extract from *The Reader*, giving an account of the jaw by gentlemen who I do not doubt are comparative anatomists, and therefore write with authority:—

"A cast of the jaw found several weeks ago by Dr. Edward Dupont, in the Trou de la Naulette, is now in the Museum of the Anthropological Society of London. Compared with the extremely 'brachycephalic' jaws which have been discovered in the caves of Arcis-sur-Aube, and from various prehistoric deposits in the south of France, this jaw represents the extreme term of a series, the other end of which is exhibited by the lowest members respectively of the Lapp and Australian races. By the quinque-raminate mode of implantation of its third true molar, by the enormous size of the canines, by the absence of any chin, by the absence of genial tubercles, by the great symphysial beak-shaped degree of prognathism which it exhibits, it affords characters which, though they may be present in different individuals of the lower races of man, have never hitherto been found united in any single specimen. During the last fortnight it is said that a canine and an incisor tooth have beenfound in this cavern. The incisior presents markedly peculiar characters, and the canine indicates its great projection above the jaw. The occurrence of these remains with those of *Elephas primigenius*, *Rhinoceros tichorinus*, and *Hyæna spelæa*, in stratified sand, subjacent to stalagmite, has been thoroughly demonstrated. The cast has been submitted to some distinguished members of the Société d'Anthropologie de Paris. One great authority, whose anatomical qualifications no one can dispute, held out for a fortnight that the jaw must have belonged to an ape, but yielded to the arguments of

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a colleague. A thorough description of the jaw has been read before the academy at Brussels by Dr. Edouard Dupont, with numerous illustrations of this and other jaws. The memoir will be published on the 1st of August. The opinion of the learned discoverer is in favour of the half-human half-pithecoid character of the being to which it belonged. A report will shortly be publicly read, accompanied by verified sections, in which the geological points involved will be exhibited, and when the palæontological and anthropological bearings of the discovery will be exhaustively discussed."

When Mr. Symonds finished there was barely ten minutes left to get to the station, and just as the party arrived there, the train came in. So ended one of the most pleasant and successful meetings ever held by the Woolhope Club.

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The Woolhope Naturalists' Field Club.

MEETING AT MALVERN,

SEPTEMBER 12TH, 1866.

An extra field meeting was held at Malvern on Wednesday, September 12th, on the invitation of the Malvern Club, to meet also the members of the Cotteswold and Worcestershire Clubs; in short, it was a grand gathering of Naturalists, and oddly enough, nothing could be better adapted to make it pass off well than the two or three hours rain which fell in the morning, for it kept all the members together in the spacious winter promenade of Townshend House, where they first met, in full enjoyment of all that pleasant freemasonry of science, which is ever the charming characteristic of Field Clubs.

The Cotteswold Club was represented by the President, Sir W. V. Guise, Bart.; Dr. Wright, of Cheltenham; the Revs. T. Lee Warner, F. Smythe, R. Hepworth, and F. Bayley; Dr. Wilton, of Gloucester; and Messrs. Beach, Moden, Nash, Pearce, and Playne.

The Malvern members present were the Rev. W. S. Symonds, F.G.S., President; Doctors Grindrod, Weir, and Williams; Professor Morris, London; the Revs. G. Munn, H. Housman, T. Smythe, and R. P. Hill, the honorary secretary; with Messrs. Ballard, Clark, Kent, Greaves, David Griffiths, and Turner.

The Worcestershire Club was led by Edwin Lees, Esq., F.L.S., Vice-President; Doctors Fraser and Sherlock; Alderman Firkins; Messrs. Burgess, Chaplin, Ponting, Pow, Rennick, Wilson, and Walker; with Dr. Harvey B. Holl, the honorary secretary; and it is but right to add that the higher duties connected with the Musical Festival then going on at Worcester, prevented many other members of this club from attending.

The Woolhope Club was the last to arrive, but as usual this year its members were in great force. The President, Dr. Bull; the Vice-presidents, Dr. Mc Cullough and E. Y. Steele, Esq.; Honorary Members, Henry Beckett, Esq. (Vice-president of the Dudley Club) and R. M. Lingwood, Esq.; J. E. Lee, Esq., of Caerleon; Colonel Colvin; Humphrey Salwey, Esq., J. Williams, Esq., and Messrs. Salwey and Nash from Ludlow; Richard Hereford, Esq., and Captain Mends, R.N.; Arthur Armitage, Thos. Blashill, J. Stratford Collins, T. Curley, and T. T. Davies, Esquires; the Reverends T. H. Bird, L. Burrows, S. Clark, W. H. Phillott, C. Smith, W. P. S. Stanhope, H. Tweed, T. West, and C. J. Westrop; Messrs. Bayliss, Macintosh, and Arthur Thompson, Treasurer.

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With such a gathering of the scientific men of the district it will readily be believed that the meeting was superior to the weather, and with Dr. Grindrod's unequalled collection of Silurian fossils, a detention of three hours was positive enjoyment. No one could fail to be struck with the remarkable display of Trilobites, the perfection of the several specimens, or the graceful elegance of their forms in the varied positions in which nature has seized and preserved them for such countless ages. Dr. Grindrod has spared no pains to get them together, and it may well be said that he has also been regardless of expense, for one little case, of the many there, the Doctor said had cost him fifty pounds. The following brief description of them has been kindly supplied :—

A GLANCE AT DR. GRINDROD'S MUSEUM.

Contributed by the Rev. H. HOUSMAN, F.G.S.

The main purpose for which this matchless collection has been made is to illustrate the geology of Malvern and its neighbourhood. The visitor should bear this in mind, as it accounts on the one hand for the absence of those gigantic fossils from the secondary and tertiary ages which are often the most showy specimens on the walls of other museums, and on the other for the overwhelming beauty and abundance of many almost local remains, which the concentrated perseverance of Dr. Grindrod has here gathered together. In fact, this collection should be regarded—at all events, in its present state—as one exclusively of palæozoic fossils, offering to the spectator a peep at the beings which inhabited mid-western England in the immeasurable remoteness of the geologic past far back beyond the age when man first walked this world, beyond the age when the huge saurians of the secondary period roamed through the subsiding seas—kings of the then creation—beyond the period of the exhuberant flora of the carboniferous epoch, when the summits of the Malvern hills, rising above the ocean, formed the easternmost extremity of that island which at last came to be called Britain.

The Malverns are generally looked upon as the result of a vast volcanic upthrow of syenite. This rock differs from granite, inasmuch as its component parts are felspar, hornblende, and quartz, whereas true granite is composed of felspar, quartz, and mica. But the late researches of Dr. Holl have given him reason to suspect that this rock, hitherto regarded as syenite, and therefore of true volcanic origin, is in fact an altered sedimentary deposit, older than the Cambrian system, and of the same age as the Laurentian rocks of Canada, and the north-west corner of Scotland. At present, however, not one single organism has been discovered to attest the truth of this theory, which appears to rest mainly on mineralogical similarity, a foundation far too uncertain to support an hypothesis of so much geological interest.

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The series in Dr. Grindrod's museum, as partially exhibited on Wednesday, commence appropriately with a fine group of these most ancient rocks; for though themselves azoic, and as we believe *pre-zoic*, they form the most natural introduction to the superjacent fossiliferous strata.

Immediately upon the syenite rests what is locally known as the Holly-bush Sandstone. For a long time it was not even suspected that fossils occurred in these exceedingly ancient beds. A few years ago, however, evident traces of fucoids and annelids were noticed in the upper strata of the deposits, and quite recently the careful searchings of Dr. Holl have been rewarded with well preserved shells in the lower beds, some 500 feet below the fucoids and annelids of the superior strata. Dr. Grindrod's museum exhibits excellent specimens of both divisions of this rock. The next section of the collection comprises an unequalled series of the fossils of the Black Shale—an equivalent of the Lower Lingula flags of Wales. These have been mainly collected by the unremitting efforts of Mr. H. Turner, of Pauntley. They consist almost exclusively of minute crustaceans, chiefly trilobites, some of which, at present unnamed and almost unknown to science, exhibit the most extraordinary forms, literally bristling over with delicate spines. In this zone there also occurs a minute lingula, and one or two other tracheopoda.

The Lower Silurian system as developed in the neighbourhood of Malvern is remarkable for the entire absence of both the great Llandeilo and the Caradoc formations. This portion of the museum is, however, finely illustrated by a series of Llandeilo trilobites, collected, we believe, by Mr. David Griffith, of Builth, and by an equally illustrative set of Caradoc species from the typical rocks of Shropshire.

Fossils from the Llandovery or May Hill Sandstone are next displayed, forming the connecting link or passage beds between the Lower and Upper Silurians.

It is, however, from the Upper Silurian rocks that the finest and most abundant specimens in this Museum are collected. Of these, the series of Trilobites is especially remarkable. Glancing over them here collected together is a very real glimpse at the inhabitants of the Palæogoric seas. Amongst others, we may particularly mention a group of that rare species *Sphærexochus mirus*, of which, until the forming of the Malvern Tunnel, only three specimens were known. Equally fine, too, is a group of the delicate *Encrinurus punctatus*—so delicate that an individual with its projecting eyes, side spines, and back spine was till lately quite unheard of. Here, however, are more than a dozen in a state of absolute perfection; some coiled up as if taking a nap, others apparently walking towards an enemy with spines erect, breathing, as it were, both defence and defiance. Tribolites of all sizes are gathered here from the mud of the primordial oceans, from the minute *Cyphaspis*, with its long spines, to the gigantic *Homalonotus*, 6 or 7 inches in length. The most jealous care in selecting only the finest specimens has resulted in magnificent tablets of the choice *Cheirurus*, *Lichas*, and *Phacops longicaudatus*, and its

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variety *Grindrodianus*—named in honour of Dr. Grindrod; while groups of that excessively rare and precious Tribolite, the lately-discovered *Deiphon* and *Staurocephalus*, excite the wonder of the Palæontologist.

As the Silurian system draws to its close, these crustaceans began rapidly to die out; of the few that appear in the Ludlow divisions of the formation, admirable remains are to be seen in this collection. Even the Devonian system has afforded a few specimens of *Phacops*, so named from the extreme beauty of its lensed eyes.

More space than we can at present afford would be necessary to enumerate at all adequately the other divisions of this fine Museum. Admirable as is the display of Trilobites, that of the Lower Ludlow Star-fishes, and Dudley limestone Crinoids are equally splendid. Indeed, we can imagine few treats more enviable to the geologist than that of an opportunity of studying at leisure this assemblage of Palæogoric fossils, and, surrounded by them, to acquire an intimacy with the strange and wondrous forms which dwelt upon the shores and beneath the waters of this globe whilst it was passing through one of the first of those measureless epochs by which, as by successive stages, it was being prepared for the habitation of man.

The collection is, indeed, well worthy of a visit, and was closely examined by the naturalists present. If the rain had not kept them there, the hour of service at the Abbey Church would have done so nevertheless; and before the time for its conclusion, on the spur of the moment, Dr. Wright, of Cheltenham, well known as an eminent palæontologist, was specially requested to make some observations explanatory of the collection of Silurian fossils exhibited by Dr. Grindrod, and said that:

No one was more taken by surprise than himself at the request now made, but if they would excuse any want of method his remarks might betray, he would without further preface endeavour to give them his passing thoughts on the fine collection of Silurian Radiata and Crustacea now spread out before them. In fact they were now looking upon the spoils of an old Silurian beach, and upon the remains of organisms whose history dated back to the early chapters of the first volume of the great rock book. Had they ever attempted to form an idea of the immensity of the time that separated that era from ours? Had they ever thought of that immense gulf which was bridged over by the formation of all the rocks deposited between the Silurian and modern times? If they had not, then the marvel of the collection now laid out before them lost much of its interest, for thousands and hundreds of thousands of years must have rolled away since the organisms now before them had lived and moved and enjoyed existence. When we reflected upon this fact, was it not astonishing to behold how conservative Nature was of her works? How beautiful these Crinoids, and Star fishes, and Trilobites still remained, after all that lapse of past time? Some might perchance doubt the high antiquity of the earth, and think this statement the dream of an

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enthusiast, but it was far otherwise, when they reflected for a moment that the processes of nature were slow and onward, and that the last few thousand years had failed to effect any very great or important changes on the earth's surface, that the ancestors of some of the same species of coral polypes now living in tropical seas had formed reefs that were probably seventy thousand years old, and if we remembered that this long period related only to existing species, what must we think of the duration of those ages that had preceded modern times?—that long vista of the past during which eighteen miles of sedimentary rock had been slowly and steadily accumulating? and, be it noted, it was at the very dawn of this far, far distant age when the creatures before them sported their little day of existence in the Silurian seas.

It was interesting, therefore, in a natural history point of view to inquire in what the past differed from the present. Let them look first at those beautiful sea lilies, the Crinoids from the Wenlock limestone, see how nicely the pelvic plates were jointed together like mosaic, and how finely the arms branched off from the cup to form a net for catching prey, see how finely the stem was jointed, consisting of hundreds of plates built upon each other, some of these stems being rooted to submarine bodies, while others were tapering and free; examples of both conditions were on the table, so abundant were the remains of Crinoids in the Silurian and Carboniferous rocks, that many thick beds of limestone were almost entirely composed of their broken up skeletons. We had two or three species of existing Crinoids in the seas of the Antilles, but they were entirely distinct from those that lived in the Silurian and other subsequent ages, although the general plan of their construction and many details of their organisation resembled their old ancestors. These Crinoids therefore ought to be carefully examined, for there were some choice specimens before them.

The next group of *Radiates* was the star-fishes, of which many specimens were on the table from the Ludlow rocks at Leintwardine. It was long thought that the Crinoids were the only representatives of the *Echinodermata* in the Silurian seas, but the discovery of these fossils in rocks of the same age in England and America had taught us to pause in our generalisations, and examine nature more attentively. On one of the slabs from the Wenlock limestone, there was a pretty specimen of *Lepidaster*, with its columns and plates around the margin of the arms. From the Lower Ludlow rocks there were various specimens of *Palæocoma* and *Protaster* in different stages of growth, interesting to all zoologists, as showing how faithfully nature had adhered to the type of organisation so characteristic of the *Asteriadæ*, and proving that the present was connected with the past by a series of links which united them in natural relation. Some fossil star fishes of the Lias beds so closely resemble existing species of that family, that it required the most careful diagnosis to detect the differences by which they were separated.

Passing on to the next group of fossils before us, the oldest forms of the articulate animals, we see a magnificent series of Trilobites, most of which

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had been found in the Wenlock shales during the excavation of the Malvern railway tunnel. The first thing that strikes us in looking at these fossils is the marvellous perfection of their preservation. Not only is the external crust of the skeleton preserved, but you see even the lateral and dorsal spines, the caudal appendages, and sculpture on the plates, whilst the eyes, with their hundreds of compound facets, are all embalmed in the rock. We see, likewise, the young, middle age, and adult condition of many species well represented before us. Let us not look at these specimens with a mere *dilettanti* eye, but rather let us scan them with the inquiring glance of the student of nature. In the first place, in these *Sphœrexochus*, *Deiphon*, *Staurocephalus*, and *Cheirurus*, you see the highly ornamented condition of the dermal skeleton; 2nd, in the compound eyes, so wonderfully preserved in this glass case full of gems, you have the proof that the atmosphere was as pervious to light, and as finely adjusted to the mechanism of the eye of this ancient aquatic articulate as is the air of the present time to the eyes of existing species; 3rdly, the changes of form which these creatures exhibited shows that, like our modern crustacea, they passed through a metamorphosis, rolled themselves into balls, and exhibited all the characters of the great class they represented in the Silurian seas. This long-tailed *Phacops*, large *Ogygia*, gigantic *Asaphus*, smooth *Homalonotus*, tuberculated *Calymene*, and inflated *Illœnus*, prove that the ancient genera in their variety and beauty could well vie with modern life. And in passing rapidly in view, these ancient organisms, if he might be permitted to suggest the thought which rose in his mind at this moment when contemplating this grand display of the denizens of the old Silurian beach, it was this, that the Almighty Author of all things had chiefly displayed to us in these His works how unchangeable was His character, for in the details of their structure, the laws of their being, and other phenomena by which present organisms of the animal creation were characterised, were found by us alike in these oldest members of the earth's first denizens; so that if it was true that hundreds of thousands of ages had rolled away since these creatures lived, the same laws that governed their being, regulated their life, and assigned them their place in creation were presiding over the countless beings of the present time; and were it possible to realise, in a material form, the words of scripture, that the Author of our being was the same yesterday, to-day and for ever, he would point to the Crinoids, the Star-fishes, and Trilobites of the Silurian seas now before them, and say, There are the evidences which declare the truth, and prove the reality of those all-comforting words.

Dr. Wright's eloquent address was listened to with marked attention, and received great applause from every one present.

A march was now made by a portion of the party to the Priory Church, where the Rev. G. Munn, Rector of Maddresfield, was in attendance by request, to read a paper on the painted windows and architecture of the sacred edifice. Some of the geologists were, however, so engrossed with Dr. Grindrod's museum that they did not hear the marching order, or could not tear themselves away, and thus lost this part of the programme.

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NOTES ON THE HISTORY OF THE PRIORY CHURCH AT MALVERN.

By the Rev. G. MUNN, Rector of Madresfield.

Mr. Munn being well acquainted with ecclesiastical architecture, and a critic in painted glass, we should have printed his address *in extenso*, had he not with extreme modesty desired this might not be done. We are therefore indebted to a friend who has himself studied the curious windows of Great Malvern Priory for the following observations, which embrace the chief features descanted upon by the reverend gentleman, and so well brought out. There was one point, too, suggested by Mr. Munn, which, as it is a reflection upon the men of Herefordshire, we cannot pass by unnoticed, as will be seen farther on, for when observations are publicly made, they are not to pass unchallenged under the plea that they were not meant to be reported.

Mr. Munn undertook to give the history of the Priory as given in its painted windows, mutilated though many of them now are, and he commenced with that clerestory window in the choir which contains the legendary history of St. Werstan. Mr. Albert Way was the first person who drew attention to the legend pictured in this window, which embodies the effort of an hermit saint to establish Christian worship among the rocky solitudes of the Malvern hills. These clerestory windows in the choir were put up in the fifteenth century by Prior John Malverne, and, no doubt, at that time there was some authentic record of the facts to which they refer among the muniments of the monastery. It is remarkable, however, that Leland is the only author that mentions St. Werstan, of whom he incidentally says, that when Deerhurst Monastery was burned down by the Danes, Werstan fled to Malvern.

In the window alluded to the story of St. Werstan is shown in four compartments. In the first a square plot of ground covered with flowers is seen, having an angel vested in amice and alb at each of the four corner stones, and in the centre is a large white key. Beneath and kneeling among flower-covered slopes and terraces is an ecclesiastic kneeling, his hand lifted up in prayer. Over his head is a scroll inscribed. Mr. Way was of opinion that this represents a vision by which St. Werstan was induced to found an oratory at Malvern; but Mr. Munn stated that it only represented "the Catholic faith," that God's angels were manifested in all acts of devotion, and especially in dedications to sacred purposes they were supposed to be spiritually present. "With angels and archangels and all the company of Heaven," the church militant on earth are said to join in worship. The key may probably represent the spiritual authority given to the hermit saint.

In the second storied pane, angels appear in the act of consecrating the oratory reared by St. Werstan, who again is shown kneeling among flower-clad cliffs, and above him are the golden-winged heavenly visitors. One blesses the

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bell in the turret of the chapel, another elevates a processional cross, a third bearing a thurifer, and a fourth asperges the church with holy water. Thus the first Christian building among the Malvern hills was reared under heavenly direction.

But this was not enough. The Catholic Church had always tried to obtain the aid of the secular arm, and fortify itself with regal sanction. So in the third compartment a small figure is seen kneeling before a tall regally vested personage, above whose crowned head, encircled with a corona, is inscribed "S. Edwardus rex;" thus intimating Edward the Confessor, who holds a charter in his right hand with a seal bearing the sign of the cross. The hermit, it would seem, desired the sanction of the crown for his proceedings, and so employed a friend at Court to obtain a charter and grant of land from King Edward; and though the monks were known to be fond of "pious frauds," and could occasionally forge charters, it does appear that the Priory of Malvern held certain lands which were said to have been originally bestowed by Edward—*quam Edwardus rex dedit.* The supplicant for the charter is represented of much smaller proportion than the sovereign, in accordance with a conventional principle of design in old times, by which persons of inferior station were often represented of diminutive size in comparison with their more powerful neighbours. This usage has passed into a proverb, and persons are said to "sing small" when their assertions are shown to be not sustainable. Edward the Confessor reigned from 1042 to 1046, but probably Werstan's sanctity had obtained some note before his efforts were rewarded by the regal grant and sanction.

The last subject of the series in this remarkable window as to St. Werstan, appears to represent his martyrdom, and in the very oratory he had built. Behind in the pictured glass are shown the steep sides of the Malvern Hills, while at one of the windows of the oratory the saint puts forth his head bleeding and bruised, whilst on either side stands a cruel murderer, prepared with sword upraised to strike the unoffending recluse. These miscreants are clad in gowns which are girt round their waists, and reach somewhat below their knees; the scabbards of their swords are appended to their girdles, and on their heads are close fitting leather coifs or caps.

Supposing the alleged martyrdom of St. Werstan to be an actual fact, a question arises as to who were the miscreants who killed the pious missionary hermit. Mr. Way suggested, generally, the wild heathen population around as not pleased with St. Werstan's ministrations; but Mr. Munn has thrown a stigma upon Herefordshire, by declaring it probable that "these miscreants *came from the other side of the hills* (Herefordshire), and that it was likely they resented the intrusion of the hermit into these solitudes, thinking that he might be the precursor of a more numerous following, and that this would interfere with their right, or rather with their *practice* of free warren." Now, such a reflection is uncalled for and without the least foundation. Herefordshire, in the days of Edward the Confessor, could scarcely be more

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heathen in character than Worcestershire, and in absence of evidence, there can be no necessity to bring a band of "miscreants from the other side of the hills" to account for the martyrdom of St. Werstan. If the saint was murdered at all it was at Malvern, and we must take exception to the gratuitous assumption that a band of miscreants out of Herefordshire did the deed from hatred to Christianity.

There was formerly a place on the side of the hill called "The Hermitage," beneath which was a rude crypt containing a few stone coffins, and this was probably the site of St. Werstan's oratory, but the erection of new buildings has destroyed all traces of it.

Besides the story of St. Werstan, the Malvern windows record the foundation of the actual Priory Church by St. Aldwin in 1084; also the grant to the same prior by William the Conqueror; the sanction of St. Wulstan, Bishop of Worcester; and the acts of donation by William, Earl of Gloucester, lord of the forest of Malvern; Bernard, Earl of Hereford; and Osbern Poncius, benefactions which materially contributed to the establishment of this religious house.

On the other painted windows, which represent Scripture subjects, it is unnecessary to enlarge, particularly as the glass in both the great east and west windows has been much disarranged, but the colours and artistic skill shown in the work is in many instances admirable. In the window of the north transept, which was put up in the reign of Henry VII., and which has some portions of its imagery entire, are kneeling figures of Prince Arthur and Sir Reginald Bray.

All that remains of the original Norman church are the round arches and short columns of the nave, the rest of the building is of subsequent date, and between the reigns of Henry VI. and Henry VII., some work or other was always in progress. While the foundation of the priory is written in the emblazoned glass, the glazed mural tiles show by the dates upon them how the interior of the church was re-edified and beautified. The eastern parts were finished first, and the various altars dedicated by Bishop Carpenter in 1460. The tower in the latest style of Gothic was built apparently by the same architect that designed the tower of Gloucester Cathedral, for both are very similar. Of the Lady Chapel, nothing now remains except the bosses of the vaulting discovered in the crypt. These are of an earlier date than any part of the present building except the nave, and seem to tell a tale of constant progressive work from the foundation to the time of Henry VII.

When Mr. Munn had concluded his paper, the company present slowly perambulated the church, particularly observing the glazed tiles which have been replaced on the walls, and which have benefactors' coats of arms upon them, as well as curious legends and devices, the instruments of the Passion, the sacred piscis, &c. The tracery of the great east window is seen to be

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produced to the ground, and the centre mullion is divided, forming an ogee arch, through which was the entrance to the Lady Chapel, which in the late restoration has been re-opened. The windows of the transepts and side aisles, in which are many curious subjects, were also examined in detail.

On leaving the Priory Church the aspect of the sky was so unfavourable, mist and rain enveloping the landscape, that it was determined to postpone the intended geological excursion up the hills and return to Dr. Grindrod's. Here accordingly all the naturalists re-assembled, and the following paper was read.

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ON THE GEOLOGICAL POSITION OF THE CRYSTALLINE ROCKS OF THE MALVERN HILLS.

By HARVEY B. HOLL, M. D., F. G. S., &c.

The oldest rocks in the district are those which, with their granite beds and their trap dykes, form the hills. They consist of various kinds of gneiss, which is sometimes in thick massive veins, at others fine-grained and thinly bedded; and interstratified with these are other crystalline and semi-crystalline rocks, as hornblend schist, mica schist, felstone, syenite, and granite. Some of the latter may perhaps be intrusive, but this is very doubtful, and for the most part, like the syenite, it is a derivative rock.

These rocks were all of them in existence before the period of the Hollybush Sandstone, as shown by their infra-position; for the sandstone rests upon them unconformably, and is not penetrated or altered by the trap dykes, and as the age of this sandstone is known to correspond with the Lingula Flags of Wales, it serves as the point of departure in our attempt to determine the geological position of the underlying rocks.

The relative position of the Hollybush Sandstone to the metamorphic rocks, resting as it does upon their upturned edges, indicates that the latter had undergone disturbance before the sandstones were deposited; and that the intrusion of the trap rocks was posterior to this uplifting is shown by the manner in which the continuity of the bedding of the gneiss, and especially the granite veins, has been interrupted by their outburst, and also by the different appearance which the trap rocks present at their margins from what they do in the interior of their mass, the more rapid cooling of their circumferential portions having rendered them less highly crystalline at their edges than they are in their interior; and from this we may also infer that the metamorphic action had long ceased, and that the gneissic rocks were no longer at an elevated temperature at the time of their eruption.

From other evidence, derived partly from the manner in which the successive beds of the superimposed Hollybush sandstone overlap the lower ones, and creep as it were up the sides of the hills, and mantle into the hollows between them; and from the pebbles of gneiss, &c., contained in their lowermost beds, we learn that the crystalline rocks were elevated above the sea level and subjected to denuding influences which formed them into a mountain ridge before the sandstones were deposited. Now, as all these events occurred previous to the period of the Hollybush sandstone, or

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Malvern representative of the Lingula flags, it follows that a very long interval must have elapsed between the respective epochs at which the two formations were accumulated; and as the Hollybush sandstone rests transgressively on the gneissic rocks, while on the contrary there is perfect conformity between the Lingula flags and the Cambrian rocks, we infer that whatever sediments were deposited upon the gneissic rocks during this long interval, over the area not now covered by newer formations, must have been stripped off again by denudation before the sandstone was deposited. Hence we may conclude that the Cambrian rocks are absent from beneath the Hollybush sandstone, and that the crystalline rocks belong to a yet earlier epoch.

There are, however, reasons for supposing that at some former period the gneissic rocks were covered by other sediments, which were again removed from off them before the era of the Lingula Flags, except, perhaps, certain rocks on the eastern slopes of the Herefordshire Beacon, which are less highly altered than the crystalline rocks of the ridge, and are clearly of a later date, and which, it is quite possible, may be a remnant of these missing strata. Unlike the older gneissic rocks, they appear to owe their altered condition to local causes, viz., to the intercalation of beds of lava and to trap dykes; and I formerly regarded them as part of the Lingula Flag series, but of this there is no certain evidence, and it is equally possible that they may be older; but as the relative position of these rocks to the Hollybush sandstone is not known, it is impossible to say whether they may belong to the Cambrian system or to some more ancient one.

We have rocks supposed to be Cambrian on the South at May Hill; we have them on the North-East at Charnwood Forest, resting directly on rocks precisely similar to those of the Malverns; we have them on the North-West at Haughmond Hill and the Longmynds; and we know that subsidence was going on at the epoch of the Hollybush Sandstone, and had probably commenced long anterior to that date; and from this and other evidence I infer that at the commencement of the Cambrian period there was in central England a large area of land which culminated in a mountain ridge, which is now the Malverns, and that as this tract subsided, fresh deposits successively crept forward towards the ridge, and progressively decreasing the area. But I do not think that there is any evidence that the ridge became sufficiently depressed for deposition to take place upon its flanks, until the period of the Lingula Flags.

This paper gave rise to an interesting discussion. Professor Morris took the same view with Dr. Holl, and considered that there was no evidence of igneous action observable in the Malvern chain. They were in reality a gneissic range of metamorphic structure synchronising with the Laurentian rocks of Canada, not of truly igneous origin, though penetrated at various parts by irruptive veins of syenite and dykes of trap, and went into a long train of argument on the subject, illustrating his remarks with diagrams.

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The Rev. W. S. Symonds said that he had carefully considered the matter, and he felt bound to say also that the old views of geologists as to the Malvern range being syenite and therefore igneous were erroneous, and he considered that though the hills had been uplifted at various times, yet that they were formed from deposited strata of very ancient date that had been metamorphosed. He thought, therefore, that the views of Dr. Holl were substantially correct, though further proof was required of the exact age of the metamorphosed rocks.

The proceedings were next diversified by a little amusing *coup de theatre* which filled up time while the party were still bound by the fickleness of the weather. Mr. E. LEES produced a rude drinking cup made of burnt clay, with zig zag ornaments upon it, that had been buried with the ashes of a Silurian chieftain on the summit of the Worcestershire Beacon, and there discovered by the Ordnance surveyors a few years ago. Mr. Lees now presented the cup to be drank out of by the Presidents of the Clubs present, after its disuse for above two thousand years, for it had been examined by learned antiquarians in London who had pronounced it to be an ancient British cup, and nothing exactly similar had been met with except in a few barrows in Wiltshire. The cup was examined with much curiosity, and many members as well as the presidents drank out of it (see plate).

Mr. W. PONTING, of Worcester, had also by request, brought some Saxon relics that had been exhumed last year at Upton Snodsbury, near Worcester, consisting of a singular amber necklace, sword, fibulæ, &c. These were inspected with much interest, and it seemed curious for these ancient objects, as far as man was concerned, to be brought in contact with nature's stores belonging to a period of incalculable antiquity—the products of a sea on which no vessel had ever sailed, and a shore untouched by any human foot.

Dr. GRINDROD, as a hospitable teetotaler, before the naturalists left kindly proffered tea and coffee to his guests, which was partaken of with as much relish as if all present had assembled at a Temperance banquet; and at length, when the rain had subsided, the word of command was given to storm the heights of the North Hill.

A new road has been recently formed for visitors, which now gives comparatively easy access to the once formidable North Hill at Malvern, and along this easy ascent the naturalists proceeded, and for a brief period transient gleams lit up the extensive landscape, and the pure air was fragrant and exciting. This gave spirit to the geologists, who brandished their hammers and cracked jokes and rocks at the same time, and *trapped* specimens of trap, with energy equal to the occasion. When the apex of the hill was reached Mr. Symonds, the President of the Malvern Club, with his usual energetic eloquence, discoursed for a short time on the aspect of the country before them in the glacial period, and adverted to the fossil remains of

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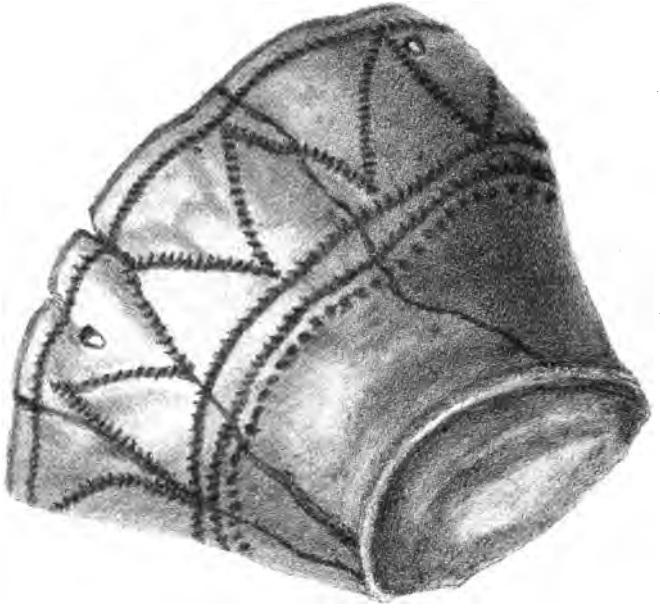

(EXACT SIZE.)

ANCIENT BRITISH DRINKING-CUP, exhumed from the summit of the Worcestershire Beacon, Malvern Hills, November, 1849; in the possession of EDWIN LEES, ESQ., F.L.S., F.G.S., &c.

This Cup is formed of clay that has been baked, and evidently rudely made by hand; and the markings and beadings impressed upon it are very deficient in regularity and unequal in depth. It has several holes perforated in its sides towards the top, by which it might have been strung up, or perhaps hung round the neck. This curious little vessel, which was found among calcined bones, doubtless of some Silurian chieftain, is in height two and a half inches, and the breadth at top three inches. The bottom is nearly three quarters of an inch in thickness. There are relics of colour upon it, as if originally tinted by some pink pigment.

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mammoths, rhinoceroces, &c., belonging to that frigid time that had been discovered in the drift at the base of the hills. As the rhimy vapours began again to encompass the hill, and time was valuable, the address of Mr. Symonds was necessarily shortened, and the party descended to the End Hill, and thence into the road below.

There was but little opportunity for botanical examination, but some quantity of *Corydalis claviculata* was gathered in flower, and the local fungus, *Cantharellus aurantiacus*, prettily adorned the mossy slopes of the hills with its orange-coloured hymenium. The rare moss, *Zygodon Mougeotii*, was also collected by a zealous cryptogamist. On their return by the northern base of the End Hill towards great Malvern the party paused at a most interesting quarry, where an outburst of trap is presented to view, full of joints, and presenting some similarity to basalt, both in its structure and constituents. Dr. Holl, who ably descanted on the appearances at this spot, stated that the rock contained 22 per cent. of iron. Hereabouts much sulphate of barytes is dispersed in the cracks of the rocks, and some large and fine chrystallised specimens of this heavy spar was collected.

On rounding the hill, considerable interest was excited by the unexpected discovery of a good solid specimen of the now almost extinct "article," a parish stocks, with a whipping-post hard by. To find such things at all is curious in these days; but to find them at modern Malvern seems a marvellous anachronism indeed. Some gentlemen forthwith got in the stocks, to say they had done such a thing; but it was tame work without the jeers of the parish boys, of which we have a lively recollection in "the good old times gone by."

At four o'clock, a party of nearly seventy gentlemen sat down, in the new concert-room at Great Malvern, to a dinner, which was good as far as it went. Never, surely, were the bones of a haunch of venison more thoroughly anatomised at table! and as to "waiting," it may be said, in more senses than one, that the guests took their share. Sir W. V. Guise, Bart., occupied the chair, and the Rev. W. S. Symonds and Edwin Lees, Esq., officiated as vice-chairmen.

Sir W. GUISE, the Chairman, almost before the cheese had been discussed, rose and stated that as it was necessary to economise time for those gentlemen who had a long distance to return, and for whom the train would not wait, he would at once proceed to business. He understood that they had all, like the club he represented, discarded toasts and speeches after dinner; but he would on the present occasion propose one only, and though it might be thought that they were praising themselves, yet if they had no one else to do that duty, he must do it for them (laughter). He would therefore propose "Health and prosperity to the associated clubs who had met in Malvern that day" (cheers). In these clubs were many gentlemen whose amount of knowledge and experience was considerable, and when they

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communicated their observations it was beneficial not only to themselves, but to the counties in which they lived, and ultimately to the world at large. Their meetings spread abroad a love of natural history, and though perhaps more work was done in small meetings than in large ones, the latter were not without advantage. He had much pleasure in meeting the members of the Malvern Field Club, as the country they had examined was a most delightful one. He congratulated them on their success, and trusted they might meet many more times, not only there, but in other parts of the country (applause).

Dr. BULL, of Hereford, who had been specially named by Sir William Guise as the President of the Woolhope Club, which stands next in seniority to the Cotteswold Club, replied to the toast. He regretted not having heard Mr. Munn's paper at the Priory from being detained at Hereford. He was told that the murder of good St. Werstan had been gravely attributed to four Herefordshire men, without a particle of authority for the statement. He could not help suspecting a little concealed fun in it, but however that might be, the Woolhope Club had shown that day that Herefordshire men could come in much greater numbers in answer to the invitations of Mr. Symonds, and to do honour to their chairman, Sir William Guise. No two men had done more to encourage the Woolhope Club, and they must rejoice in its success during the present year, for the Woolhope Club had held four meetings with an average attendance of 54. They were perennial Presidents—evergreens rather he should say—for were they not always ready to promote natural science in winter as in summer. For himself he was merely an annual, his reign would soon be over, but he would be succeeded by a more able man, and he hoped they would come next year into Herefordshire to see how spiritedly the Woolhope Club now carried on their meetings.

ELMES Y. STEELE, Esq., Vice-president of the Woolhope Club, then made some observations on a very fine and perfect specimen of *Cephalaspis Asterolepis* which he exhibited to the meeting.

Mr. E. LEES was next called upon, and read the following paper.

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ON THE PLANTS OF THE MALVERN HILLS, AND THEIR ORIGINAL DERIVATION.

By EDWIN LEES, F.L.S., F.G.S., &c., Vice-President of the Malvern and Worcestershire Naturalists' Clubs.

Mr. LEES introduced his paper by remarking that, in contemplating the emblazoned windows of the Priory Church that morning with his friends of the various Clubs, while Mr. Munn described the painted glass, he could not help thinking how men in general were influenced by the colouring of things, and the medium through which objects were viewed. He would, therefore, treat them with a moral reflection before proceeding to the details of science, and he felt inclined to say that, as passion, whim, or prejudice often coloured or discoloured whatever lay before the view, so even naturalists were influenced by the theoretic views that at times tinged their descriptions and gave them a peculiar hue. To all objects and pursuits a colour might be given according to the fancy of the describer, and it therefore became necessary to examine everything closely, and not trust to the mere colour of the surface, or to a tint that, laid on deceptively, might not be of an enduring nature. Bright colouring was, however, always attractive to the eye, and thus it was that the flowery garb of Nature never failed to please the wanderer, and the poet who wished to adorn his descriptions, scarcely ever omitted to pluck some flowery wreath, or, like Milton, was incited to—

> "Call the vales, and hither bid them cast
> Their gems and flow'rets of a thousand hues."

Mr. Lees then read the following remarks on the

FLORA OF THE MALVERN HILLS.

Everybody, whether actual botanists or not, admits the interest that there is in the contemplation of plants, for with the revivification of vegetation in the Spring, the world of life and beauty awakens to delight the gazer upon the face of Nature. As Wordsworth has well said—

> Bright flowers! each coming year hath view'd
> Their myriads—endlessly renew'd;
> Wherever strikes the sun's glad ray,
> Where'er the joyous waters stray;
> Wherever sportive zephyrs bend
> Their course, or genial showers descend;

they offer themselves to please and gladden the delighted eye.

The variety that Flora presents in different localities is a source of perpetual interest to the wandering botanist; and as in almost every place where there are hills and streams some particular plants are found that rejoice in such favoured spots, the botanist looks out for what he fondly denominates

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the rare plants of the district, and is tempted to roam from one habitat to another for the peculiar species that are confined, from height and other circumstances, within prescribed limits. These plants are catalogued, and form what is technically called "THE FLORA" of a district or country. A mere list of orders, genera, and species, such as are usually given in a Flora, even when subdivided into districts, by no means presents to the mind or the eye a notion of the prevailing vegetation anywhere. The statement that the following plants, among others, grow on the Malvern Hills, viz. :—

Pinguicula vulgaris	Sedum album
Anagallis tenella	Potentilla verna
Chrysosplenium alternifolium	Mænchia erecta
Narcissus pseudo-narcissus	Corydalis claviculata
Montia fontana	Gnaphalium sylvaticum

or an entire list of all the plants growing there, by no means gives an adequate notion to the mind of the vegetation making up the aspect of the hills; and so with other portions of country, the woods, the upland meadows, and the banks of rivers. To do this, reference must be made to what Baron Humboldt has called the "physiognomy of vegetation," and then the different parts of any region may be contrasted with each other. Even portions of the same chain of hills may show differences of aspect, according to the plants clothing the ground, and among the Malverns the appearance of the well-named "Hollybush Hill," ever robed in the dark verdancy of that spiny-leaved tree, offers a remarkable contrast to the treeless North Hill, invested in summer with a robe of glowing purple from the numerous foxgloves *(Digitalis purpurea)* that then cover it. In early spring the verdant mosses and the light green *Euphorbia amygdaloides* give beauty to the slopes, while later in the year the exposed sides of the Malvern hills are refulgent in gold from the extent of blossoming autumnal furze *(Ulex gallii)*. The common brake *(Pteris aquilina)*, equally abundant about the bases of the hills in autumn, as that season approaches combines the burnt sienna of its fading fronds with the dark-green of the furze.

Then again, in different seasons particular plants, from meteorological or unknown circumstances, swarm in an extraordinary way, and give a feature to the landscape that may not occur again for years. Thus, at times, the great brown withered-like parasite *Orobanche major* will appear among broom; the bitter cuckoo-flower *(Cardamine amara)* be abundant on the side of little rills; the golden *Chrysosplenium* in similar spots; the beautiful twining wood vetch *(Vicia sylvatica)* profusely in woods; the purple saintfoin *(Onobrychis sativa)*, and the pyramidal orchis *(O. pyramidalis)* on limestone rocks; or the *Œnanthe phellandrium* by pools, and the elegant rose-clustered dropwort *(Spiræa filipendula)* filling upland meadows.

This variety in the aspect of vegetation contrasts with rocks as distinguishing countries, for as Humboldt has well observed, the granitic rock, the basaltic column, and the limestone ridge, is the same in Iceland and Sweden as in Mexico and Peru, but who could mistake the vegetation of those distant

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countries? Even animals are seldom seen in sufficient numbers to give a character to the landscape, and their restless perpetual motion removes them from our view; but trees affect us by their magnitude and stability, flowers by the beauty of their colours, and herbs by the freshness of their verdure.

At a meeting where learned, acute, and experienced naturalists long inured to investigation are assembled together, I should like to take a wider view than the mere enumeration of plants now growing upon these rocks, or on the confines of the Malvern country. I should wish, if it was possible, to connect past with present vegetation, and excite geological as well as botanical interest. But it is impossible fully to do so here; and even to go back only to those times that we all acknowledge, when a strait or channel swept through the vale of Worcester, from the Mersey to the Devonshire coast, thus isolating Wales—when of course numerous littoral plants must have then lined the shore – it is only in the Longdon Marshes that the *Scirpus maritimus* yet existing, gives us an indication of a former *maritime Flora*, and perhaps the abundance of *Œnanthe pimpinelloides* near Forthampton and Powick. I have, indeed, gathered the Sea Storks-bill *(Erodium maritimum)* here in years past, perhaps another trace of sea-shore vegetation, but that is now gone by the intrusion of donkeys at the habitat where it grew. To penetrate backward into the arcana of fossil vegetation is a difficult task, and almost beyond the reach of botanical effort—in fact, so uncertain is the diagnosis of fossilised plants that, except generally as to fucoids and ferns in the secondary deposits, I much doubt whether many other plants there can be certainly identified; for the coal vegetation has given rise to very discordant opinions as to what it consists of, and even roots have been considered as distinct plants. Yet if zoologists can trace life from its lowest forms in ancient deposits to the grander consummation of mammalian animals of later date, it might be supposed that vegetation had something like a connecting chain to show, linking the past to the present. The tertiary beds have, especially on the continent, indeed, presented beautifully preserved leaves, from which the families to which they belonged have been educed; and this has led to the remarkable conclusion adopted by Dr. Seeman and other able botanists, that the present flora of Australia very much resembles what was the characteristic vegetation of Europe in tertiary times, and that it is a remnant of that vegetation which was kept in existence by progressing from Europe in the direction of Australia. The general forms of Australian vegetation such as the Banksiæ and the leather-leaved Eucalypti have more affinity with the relics of tertiary vegetation than with the living forms now in Europe or elsewhere. Admitting this, then, without necessarily following up Dr. Seeman's argument, that this vegetation, which includes so few edible fruits, was insufficient to sustain human life if any then existed, or at any rate any large population, then comes the question, from whence arose the present vegetation around us, and is it derivable from any ancient source? I infer that vegetation has been always migratory from certain centres of creation, and that

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there are such centres seems probable from the abundance of forms on particular lofty chains of mountains. The more extensive and lofty the mountains the more numerous and varied the families of plants. Hence it is that English botany is comparitively poorly developed, and all derivative. Let any botanist take the entire range of these hills of igneous rock, as generally considered, and from end to end he will find that the stigma of the poet,

The bare and herbless granite,

applies equally to these syenitic irruptions as to the granite itself, for not thirty remarkable flowering plants will be found that can be esteemed truly native, and all of these are derivable from the European continent. The Foxglove, very abundant here, is generally a devoted lover of igneous hills; but plentiful as the Gorse is now, studding the Malvern slopes, I have reason to doubt its ancient allocation here, and would not pledge myself to its existence in the time of Caractacus. An English botanist would peregrinate twenty or thirty miles to be assured of finding only half a dozen rare plants; and yet, as I observed only a few weeks since, at Zermatt in Switzerland, when ascending to 8,000 feet of elevation there, on a particular day, I gathered more than 200 alpine plants all remarkable and worthy of note. Here then are, if not centres of creation, favoured localities for plants now, and yet we have no clue to trace them back as descendants of former vegetation, nor would the Darwinian hypothesis avail us without an assumption irreconcileable with observed facts. Yet these alpine rocks, redolent with numerous forms of vegetative life, are confessed by geologists to have a later origin than many rocks in this country that have no true endemic flowering plants to show. This is a difficulty which geologists have failed to explain, and it is not easy to account for the phenomena displayed. Old rocks would seem to be likely to nourish old world plants; but if the younger rocks attain a higher elevation, then they have peculiar forms unknown to older though lower rocks. Thus there is no flowering plant peculiar to the Malvern chain, though it might have been considered probable there would be. My friend Mr. Symonds, in one of his delightful books on old stones and "stones of the valley," which he knows so well how to throw and hit with too, has speculated on Alpine Gentians beautifying these Malvern rocks when they were at 15,000 feet of elevation. But where was the *Gentiana* to be got from at that early time, seeing that the Alps on which it now flourishes had not then been elevated? Perhaps if the Malverns were again lifted up, the lovely Gentian might show its intensely blue flowers there; but what was on its hoary brow countless ages ago, I would not venture to say, nor has an alpine plant of that date survived upon the range in any part. If then, there are any plants of very ancient date upon the Malvern Hills, they must belong to the Cryptogamous division, and among this tribe it may be possible to go a long way back. A lichen on a rock may be older than a yew-tree, and if not in its actual thallus as now visible, must yet in its family as lineally descended, and it may probably in few descents be many thousands of years old. Here, as one of our

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observant poets has truly said, appear

> The living stains which nature's hand alone,
> Profuse of life, pours forth upon the stone,
> For ever growing, where the common eye
> Can but the bare and rocky bed descry.

The lichens next to the fucoids must have been the earliest vegetation upon land, and when they had commenced nothing would destroy them, and the lichens must be our oldest aërial plants. Some of the rocks of this very North hill are coated with a sooty perennial covering that bears the name of *Parmelia stygia*, and it clings so close to the rock as to be with difficulty removable from the stone, and thus gives it a sable hue that extends slowly but surely for centuries, yet even this cryptogamic vegetation is migratory, and no one can tell from where it may have progressed. It may have existed on these rocks for ten thousand years and yet be not original here, but derived from some other point. The air is filled with minute sporules of cryptogamic vegetation, and thus it is that a roof or wall in the course of a few years becomes covered by a minute though conspicuous vegetation, that owes its origin to the sporules that have been dispersed by the winds or brought down in rain. A rock though of modern age when exposed to atmospheric action (for the air is full of spores of Algæ, Fungi, and Lichens), soon becomes covered with an escutcheon of pretence, though from what origin or source derived it would be impossible to say. Walls and battlements in like manner nourish ferns, and where after a time there is mould enough derived from the decomposed rock, or from the ashes of dead cryptogams, flowering plants and even shrubs and trees at last appear, till a ruin like Tintern Abbey or the Coliseum at Rome becomes as thickly clothed with vegetation as a rock itself of nature's formation. Such features form pictorial scenes that attract the eye of poetical observation, and this Lord Byron has remarked justly and truly—

> I stood within the Coliseum's wall
> 'Mid the last glories of eternal Rome;
> The trees that grew among the broken arches
> Wav'd dark in the still midnight, and the stars
> Shone through the rents of ruin.
>
> Some cypresses upon the time-worn breach
> Appear'd to skirt the horizon, yet they stood
> Within a bow-shot. Where the Cæsars dwelt,
> Now dwell the tuneless birds of night, 'midst groves
> That spring from ruin'd battlements,
> And twine their roots with the imperial hearths.

More than 500 plants have been enumerated in the "Flora Colisæa," as colonized by nature on the ruins of the Coliseum at Rome. So on these rocks I have noticed lichens to the number of 254, and my friend, Dr. Holl, who has paid much attention to this tribe, has added many to the amount, while a few have been from microscopic examination referred to the Fungi. Mosses too have luxuriated in the recesses of these rocks, if not to the same numerical amount of species, yet individually to a greater extent, forming a wide verdant inundation; and some of the Jungermanniæ, especially *J. Tamarisci*, have spread sufficiently to give a remarkable local colouring to the rocks—giving

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them in fact an artistic tinge which they would not otherwise have possessed. However old, then, and from whatever source derived, Cryptogamic vegetation especially, because ascending higher upon the mountains, conserves the surface of rocks and prevents that destruction which would otherwise be their lot. Here on the Malvern Hills, the Mosses, the Lichens, and the Grasses have almost entirely furred up the rocks, and they cannot now be lowered except by artificial means. In this way rocks become remarkably tinted, and bear in Wales and Scotland the names of Black or White, from the hues of the lichens upon them. Monte Rosa, among the Alps, has been so named from its rocks being reddened by cryptogamic plants upon them, as I noticed when in Switzerland during the present summer in the vicinity of the chain of Monte Rosa. As high then as vegetation will grow, which is rather more than 9,000 feet in Europe, so far will vegetation by an extended growth cover rocks with a protective shield, and above this ice and perpetual snow glazes the rocks with an enduring coat, that is only melted under exceptional circumstances.

Denudation has in times past prevailed to an astonishing extent, but on the retirement of the sea this has been stopped by the growth of vegetation; and in modern times only floods under peculiar circumstances, or earthquakes, can make any perceptible difference in the aspect of a country or in any way alter its grand features. Even in a volcanic district vegetation creeps on to the verge of smouldering fires; and the old craters of Auvergne, in France, are covered with grasses, and, as I have noticed, have now herds of cattle feeding within them, and thus retain their concavities uninjured. So it was with the old crater of Vesuvius previous to the eruption in Pliny's time. Plants, whether flowering or cryptogamic, must then have been migratory from a very early period, and whether any now on the earth are, strictly speaking, *endemic*, that is, living as natives on the spot where first placed, may, even in the case of alpine ones, be questioned. Instructed by modern instances, we see in the case of the Canadian water-weed (*Anacharis alsinastrum*) how a plant may be insidiously introduced into a country and so spread as to appear as a true native to present obervation. What is true of the Canadian weed in the present day applies to the common stinging-nettle in former times, which, when once introduced, spread in all directions, and could never be banished or effectually destroyed. In South America at this moment leagues of country are overgrown by European migrating thistles, that would appear to a stranger as truly native as any other production he saw. And so in Australia, European weeds have spread to such a degree as to cause an Act of the local Parliament to be passed to attempt (though vainly) their eradication. In like manner the old flora of St. Helena, and other oceanic islands, is dying away, while modern interlopers fill up the ground. This may happen, and no doubt has happened, over and over again.

We no more see on the earth its primitive vegetation, as originally placed, than we see in the Alps and other mountainous ranges the original conforma-

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tion of the earth. Metamorphosis seems the rule in the changes that rocks present from their earliest deposition; but perpetual migration, founded perhaps on meteorological conditions, regulates the distribution of plants, and not a slow alteration from one species into another. What may be effected in "countless ages" by a theory like Darwin's, is but hypothetical after all, whatever may be said in its favour; but the change in the vegetation of a country by migration perpetually going on is within our own observation. If those botanists are correct who infer the vegetation of Australia to be the oldest now alive on the earth, from its similarity to the Tertiary Flora, that appeared to be extinct, the argument as to alteration of species or family by gradual change falls to the ground. If the Australian Flora is deemed a relic of the Tertiary period, from its affinities to Tertiary vegetation, then vegetation of a different character is not so derived. If the Australian vegetation has roved from other lands that could not now nourish it, then the present European vegetation may have started into existence from other lands that have now disappeared, and in the case of Alpine vegetation, arising on mountains elevated at a late geological period, I conceive that there can be no other conclusion. Thus all vegetation has been fugitive—always changing its position as far as we can now penetrate into the misty and undeterminable ages of the past.

I do not mean to say that such a view is without its difficulties, or that there may not be certain secluded spots on the earth's surface where original endemic vegetation may yet abide. But we see the migrating principle before us ever causing alteration from this principle alone, and it is more reasonable to suppose that this has ever been the plan of Nature, than that the variety we now see is the result of a slow change by which from a few original forms unnumbered species or varieties have been derived. I acknowledge that we must step back to a vista not easily descried. The Malvern flora is all derivative. The flora of the British islands is derivative also, and it can be traced; and so the flora of all Europe may be derivative, though its source may not now be as evident as the connection of the Australian vegetation with that of the Tertiary period. If we look at the treasures concealed in the carboniferous rocks, we there see abundance of ferns, some of them as similar as possible to ferns of the present day, and none can doubt that ferns must have revelled in the moister places of the earth from the carboniferous period to the present day. Here, then, ferns have continued ferns, and if they could be found farther back in the world's herbarium, I do not believe they could have been anything else.

Instead, therefore, of believing in the increase of forms of vegetable life upon the earth from change of species perpetually progressing, I believe they are growing less; for whatever the horticultural creations of man they cannot be made to last long, and many curious varieties after existing for a time, instead of remaining permanent, are lost; showing that however vegetation

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may "sport," as it is called, it finally returns to the original type instead of progressing onwards.

My own idea, then, is, however far back we may try to go in the history of the earth, when elevated above the dominion of primæval seas, we shall find a distributed vegetation of varied character, and that circumstances have either restricted or multiplied this original vegetation, spreading it widely in some cases over vast areas, like the little groundsel, the thistle, or the aspiring pine; while in others, as in the case of some rare orchids or other plants only once or twice found, or limited to particular spots, there has been no extension of the species from the original place where it first vegetated. Greater variety formerly existed on the earth's surface, both as to animals and plants, than at present, and in the fact of numerous animals and plants having become extinct, this is undeniable. Slowly but surely this will go on, because nature in its wildness and man in his advance to civilisation and increase of dominion are incompatible. Nature makes neither new animals nor new plants now, though discoveries may yet be made of what were previously obscure or unknown; but at length there will be fewer lands to conquer, the ground unobserved becomes every year less, and in a few centuries hence, if fresh islands and continents are not raised from the sea, there will be scarcely any *terra incognita* at all from one pole to the other. The value, then, of all past careful observation by scientific men becomes of increasing interest, because it is certain that, with colonisation in every part of the world, the spread of culture, and the necessity of utilising every spot of ground as population increases, that numerous animals and plants will altogether disappear from the earth's surface; and though man's ingenuity may never cease to adorn the garden by his pressing the powers of Nature to the utmost point to which they may be carried, yet Nature herself intruded upon and displaced from her wild haunts, will in the publicity to which she must become exposed, originate nothing fresh there; and in botany especially the catalogue of new plants must eventually be closed, unless (as Fries says) we are compelled to make the species of a plant depend upon the presence or absence of a single hair.

To the past, then, we must look for information on the earth's history. That will always have a treasury whose recesses invite exploration, when the present scene, at last everywhere invaded by chimneys, smoke, and noisome smells, has become flat, unprofitable, and, to the naturalist, all but exhausted.

Ere the paper was quite concluded, the inexorable train obliged the Woolhopeans and Cotteswoldeans to migrate, like the plants mentioned, in different directions, and though the Malvern and Worcester divisions prolonged the sederunt for some time longer, nothing further of any interest was brought forward, and the proceedings were closed for the day, and for the season as well, with most of the clubs.

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The Woolhope Naturalists' Field Club.

THE ANNUAL MEETING—FEBRUARY 26TH, 1867.

The annual meeting of this flourishing and useful society was held at the City Arms Hotel, in this city, on Tuesday, when Dr. Bull, the retiring President, occupied the chair, and there was a large attendance of members. The President reported fully the proceedings of the Central Committee throughout the year, and read a statement of the accounts, which showed that, notwithstanding an increased outlay, the society had added a balance to its reserve fund. He stated that the number of members had considerably increased in the year. The report and statement of accounts were duly adopted; certain proposals with the view of enhancing the permanent value of the Society's Transactions, were agreed to; and four field meetings were fixed, to be held at Colwall, Llandrindrod, Ludlow—so as to meet the British Archæological Institute—and Woolhope.

Chandos Wren Hoskyns, Esq., of Harewood, was then unanimously elected President for the ensuing year.

The PRESIDENT-ELECT, amid applause, expressed his inability to find words which would adequately express his sense of the kindness shown him by his fellow-members of the Woolhope Club in appointing him to the office of president. He felt, in accepting the post, that it was a high honour, more especially when he bore in mind the great ability and the conspicuous business talent which had been displayed by Dr. Bull in his year of office (applause). The management had been admirable in all respects, nothing having been wanting to complete the success of the various meetings; and he felt that this made the task of any one who followed Dr. Bull in office more difficult. In regard to geology, he confessed that, although he had been a member of the Warwickshire Field Club—one of the earliest after the Tyne-side, which was the original of all these clubs—down to the time when he had become a member of the Woolhope, he felt that the progress of the science of late years had been so great as to leave him behind. He was glad, however, to find from the transactions, that the geology of the district had been carefully studied and described: and he should be happy to render his services as president towards the further cultivation of that and the other branches of the natural history of the county (applause).

The following gentlemen were then elected vice-presidents for the year:—The Rev. S. Clarke, the Rev. Thos. Woodhouse; H. Salwey, Esq.; and T. Curley, Esq. The honorary secretary, the Rev. George H. Cornewall, the Treasurer and Assistant Secretary, Mr. Arthur Thompson, were re-elected unanimously; and, after the transaction of the remaining business, the President called upon Mr. Blashill for his paper on the Water Ranunculi.

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VARIETIES IN THE WATER RANUNCULI.

By T. BLASHILL, Esq., of London.

Having several years since made a collection illustrative of that very difficult group of plants included under the popular name of water crowfoot, I am requested by our President to submit a few notes upon them to the club, with the view of drawing attention to the present state of our knowledge of these plants, which I believe all practical botanists consider to be rather unsatisfactory.

The genus Ranunculus is one of those which range over a great variety of soils and situations: there is, indeed, hardly any description of site for which one or other of our British species is not adapted. First there are the species of water crowfoot, which belong to ditches, pools, and rivers, and allied to them is the ivy-leaved ranunculus (*R. hederaceus*), the plant of very shallow water. *R. sceleratus* grows in muddy places, *lingua* and *flammula* in marshy places, *ficaria* and *auricomus* in moist shady places, *acris* and *bulbosus* in meadows and pastures, *repens* in waste ground, *hirsutus* and *arvensis* in corn fields, and *parviflorus* on dry banks. The steps between these several species is never very wide, even if we omit to notice some intermediate foreign plants, and several of our native species are subject to a considerable degree of variation when they stray out of their native and proper localities, I have specimens of *hirsutus* which from growing upon mud have acquired very much of the character of *sceleratus*, the plant of muddy places; *acris* is said to change similarly under the like circumstances, and this plant also forms a small alpine variety. Such facts as these should prepare us for a considerable amount of variation in other species of the genus.

In order to present a clear view of the Water Ranunculi I have chosen to adopt the arrangement, and use the illustrations of the last edition of "English Botany," by Mr. John T. Boswell Syme, that being, I believe, the best hitherto published. This arrangement is as follows:—

Species 1—*R. circinatus*, which has submerged leaves only: these spread out into a rounded shape, in one plane, and give to the plant an appearance very distinct from other species which grow in similar places.

Species 2—*R. fluitans*, the plant of rivers, where its long stems and thread-shaped leaves form a conspicuous object in such strong streams as the Severn and the Wye.

Species 3—*R. aquatilis*, which is divided into four sub-species, thus (1) *R. peltatus*, of which there are these three varieties, α *vulgaris*, β *floribundus*, and γ *pseudo-fluitans*. The last of these varieties grows in running water, and differs from the more common forms of the plant by producing under water long, tassel-like, collapsing leaves, and in general appearance it resembles *R. fluitans*. Floating leaves are rarely produced. It grows abundantly in the river Arrow at Pembridge. (2) *R. heterophyllus* has submerged leaves, which

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"collapse into a pencil when taken out of the water." Its floating leaves are almost circular, inclined to be divided into five segments, and the margins are formed of straighter lines than in the last sub-species. (3) *R. Drouetii* is a slender plant. It has seldom any floating leaves: its submerged leaves collapse when drawn from the water. (4) *R. trichophyllus* seldom produces floating leaves, its submerged leaves are "short, divaricate, comparatively rigid." There are other minute distinctions between these varieties founded on the flowers and seeds.

Species 4 is *R. Baudotii*, which grows chiefly in brackish water, and, so far as I can judge, has the thickened fleshy form which one expects to see in the plants of such a locality. One variety of it, *B. confusus*, grows also in fresh water.

The remaining members of this group—*tripartitus* (one variety of which has been found in England), *Lenormandi*, and *hederaceus*—are less closely allied in appearance to the preceding species, but the bond of union between them is closer than would be inferred from an inspection of our British species only.

This being, perhaps, the most clear and intelligible arrangement for showing the different forms, we may now look at the way in which they have been dealt with by other eminent botanists. In the older books four varieties of *Ranunculus aquatilis* are recognised. These seem to be—1st, the common form, which has floating and submerged leaves; 2nd, that which has submerged leaves only; 3rd, *R. fluitans;* 4th, *R. circinatus*. Mr. Babington, after having in previous editions of his manual treated the forms of *aquatilis* as varieties only, has in his last edition elevated them to the rank of distinct species, so that the whole group now stands as follows:—

R. trichophyllus	*R. Baudotii*	*R. circinatus*
Drouetii	*floribundus*	*fluitans*
heterophyllus	*peltatus*	*cœnosus*
confusus	*tripartitus*	*hederaceus*

Now Mr. Bentham considers these twelve different forms to be but varieties of one species, upon which he makes these remarks;—"Many of the forms it assumes are striking and have been distinguished as species, but the characters, although to a certain degree permanent, appear at other times so inconstant, and even to depend so much on the situation the plant grows in, that we can only consider them as mere varieties." In his last edition he recognises *hederaceus* as a distinct species, though somewhat against his private judgment, remarking that varieties occur in southern Europe which ally it to *aquatilis*.

Here are three very different views put forth by botanists of the first rank, and two of them at least must fail to convey an idea of the true relation of the plants to each other. Are they several species or one species? or are several of them to be considered as "sub-species"? The last term is applied by Mr. Lyne to "plants which have less strongly marked differences between

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them than are found between generally received species, but which are, nevertheless, too constant in their characters to be considered as merely varieties." It is a very convenient term when used merely for grouping plants as to the true relation of which there is a question. Judging, however, from local experience chiefly, and therefore at great disadvantage, I venture to doubt whether the term "sub-species", as applied to the different forms of *R. aquatilis*, conveys an exact notion of their relationship. For if the variations which distinguish them are permanent under all conditions of the plant, and appear to have always existed, they must be separate species, however small the difference between them; and, on the other hand, if they are neither original nor permanent forms, they must be merely varieties, however great their diversity.

With the view of forming an opinion on this point in relation to the various forms of the *Ranunculus aquatilis* of Linnœus, I searched the waters of one locality. Within half a mile of Garnons, I found specimens of every form of the plant which could possibly have grown there. There were the so-called species and sub-species *fluitans, peltatus, floribundus, heterophyllus, Drouetii* and *trichophyllus*. There was, I thought, a distinct character in the water of the habitats of these different forms, but upon this point I should be glad of further opportunity of examination, and also of the experience of other observers. In that difference of character I thought I saw sufficient provocation, so to speak, for all the variations in the forms of the plant, especially in such a variable genus as we know this to be. My specimens of the ordinary forms of *aquatilis* were from ditches of clear still water. In a pool through which a spring ran, grew the sub-species *heterophyllus*. *R. Drouetii* grew in a pool which was thick with whiteish mud from land drains. *Trichophyllus* was in a large clear pool. In the strong currents of the Wye which drag and keep the plant beneath the surface, and are subject to frequent changes of level, there was of course *R. fluitans*, but even here I found one specimen with a true floating leaf, caused, I have no doubt, by accidental protrusion of the end of a single stem abovethe surface in very still water. The names of the above forms are given to them by the best authorities to whom the plants have been submitted, including Mr. Boswell Syme. I would not myself take any responsibility about them, for in common with others whom I have consulted, I have found the greatest difficulty in applying the distinctive characters found in books to actual specimens—such distinctions as those founded on the submerged leaves which either collapse or remain divaricate when taken out of the water—the extent to which the extremity of the stem projects above the surface (which seems to be a question of specific gravity.) The occurrence or not of floating leaves (which probably depends upon similar causes) all seems insufficient to found any reliable distinction upon, and I believe they are found unreliable in practice. When the stems of *aquatilis* turn down again into the water after flowering, the submerged leaves are again produced above the floating leaves. When *fluitans* grows upon mud, from

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which the water has retired, it produces leaves having short wedge-shaped segments exactly as *aquatilis* does under similar conditions.

Nor do the more permanent and generally trustworthy characters which are drawn from the seeds seem to be in this case of much greater value, for after careful inquiry amongst thoroughly practised botanists, I have found no one who could say from his own experience that it was possible to make the book characters agree in the case of the more closely allied varieties—and the authors are certainly at variance with each other. This being the case, I suggest to the members of the Club who have the opportunity, that they should carefully examine and note the variations of the plant in such localities as these, viz. :—A strong river like the Wye, a brisk stream like the Arrow, a rivulet of spring water, a pool in rich pasture land, a pool on peat or gravel, and a piece of brackish water. Note also whether the water is tainted by manure. It would be interesting to observe how the plants behave when removed to different localities, and when the upper part of the stems of these form, which do not usually produce floating leaves, are artificially elevated above the surface.

I am strongly inclined to believe that the seeming constancy of character in these plants only exists so long as the conditions under which they grow remain constant, or at any rate that a few generations would suffice to change any one of them into another variety. I am not sufficiently acquainted with the foreign varieties allied to *hederaceus* and forming links between it and *aquatilis*, to give an opinion as to that species ; but as to the others the probability of their being really no more than forms of the same plant appears great. In any case the subject will repay investigation ; and we hope to be able to throw some further light not only upon these allied species, but upon other varieties in plants about which great diversity of opinion now exists.

(The paper was illustrated by numerous specimens of the different varieties, and many well-executed water-colour drawings.)

At the close of the paper, Mr. EDWIN LEES, F.L.S., Vice-President of the Worcestershire Natural History Society, said he agreed generally with the conclusions of the writer of the paper, and had considerable doubt as to the so-called species into which *Ranunculus aquatilis* was divided. He felt this the more strongly because he found botanists differ so much in their identification of supposed species. In one instance the same specimen of a plant had received ten different names from different botanists (laughter) ; and further, he had known the same specimen receive different names from the same botanist on its being several times submitted to him (laughter). The fact was that it was exceedingly difficult to identify plants from the descriptions given by many botanists, and this was specially the case in regard to these supposed new species. He was strongly inclined to think that all the presumed species or sub-species of *R. aquatilis* were really referable to the variety of position

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occasioned by the still or running water, in which the plant grew, and that this variation produced the many intermediate forms that were to be met with. As an example of the power of the water ranunculi to accommodate themselves to altered conditions of growth, he mentioned the case of a plant growing in the Severn near Worcester: the level of the water being raised several feet some years ago, the plant continued to live, but, being unable to reach the surface, ceased to flower. Last year, however, the level of the water being lowered, the inflorescence appeared (applause).

Mr. FLAVELL EDMUNDS could, from his own observation of the varied forms of the water ranunculi, corroborate the opinion expressed by his friend Mr. Lees. In many places within five miles of Hereford, intermediate forms between the supposed new species or sub-species were to be found. Soon after first finding *R. cœnosus* in a roadside pool at Longworth, he was passing a pool in the Breinton lane when he thought he saw another specimen, but on examination it turned out to possess submerged leaves in addition to the floating leaves: the pool was deeper than that at Longworth, and the plant accommodated itself to the conditions of its habitat. This drew his attention to the variations in form, and he found so many others as to convince him that all the variations between *R. hederaceus* on the one hand and *R. fluitans* on the other were produced by variety of position. In a shallow pool, in a rich soil, the plant produced only floating leaves; and the other forms were explained by the greater depth of the water, the presence or the absence of a stream, and its greater or lesser force, until the observer came to the *R. fluitans* as found in the Wye at Eaton Bishop, five or six feet long, with a thick hollow stem, long tassels of submerged leaves, and no floating leaves at all. He exhibited a specimen of *R. hederaceus*, from a shallow runnel on the summit of the Longmynd hill near Church Stretton, and contrasted it with the specimen figured in one of Mr. Blashill's drawings, as an example of the effect of unfavourable conditions on the development of the plant.

The PRESIDENT-ELECT expressed his concurrence in the view that the variations referred to were due to soil and position.

The CHAIRMAN presented the thanks of the meeting to Mr. Blashill for his interesting paper.

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METEOROLOGICAL OBSERVATIONS FOR 1866.

By E. J. ISBELL, Esq., and Mr. COOKE.

In consequence of my absence from Hereford during the first half of the past year, I have been compelled to leave the compilation of the annual Meteorological Table almost entirely in the hands of my friend, Mr. Cooke. This table now appears in the usual form. Had it not been for my departure from Hereford several columns would have been added; but some important instruments, being my own, were carried away by me when I left this place, and thus a series of interesting observations was, I am sorry to say, broken through and not resumed until my return.

In the construction of the table, Mr. Cooke has made use of the standard barometer belonging to the Woolhope Club. This instrument, which was once in my charge, has stood ever since it left my hands in Mr. Bezant's shop, and it was agreed that Mr. Bezant's brother should register the readings daily, and that Mr. Cooke should correct them. Since the first day of August, however, I have myself registered and corrected the barometer readings, using my own standard, as it is very important to be certain that the instrument is read off at the same hour every day.

According to our observations the average height of the barometer at Hereford during the year 1866, was 29.683 inches. It must be remembered, however, that we do not reduce our observations to *sea-level* because we wish to furnish the *local* height of the mercurial column; and as Hereford is, according to Mr. Curley, 158 feet above the sea, and the barometer cistern about 170 feet, the difference in reading between this instrument and one placed at sea-level would be equal to two-tenths of an inch.

The average height of the barometer in England at the sea-level is 29.95 inches (Barometer Manual); it appears therefore that the mean of all the barometer readings registered during the year 1866 by Mr. Bezant and myself is nearly the same as the average determined by the highest authorities, allowance being made for the height of this city above the sea.

The thermometers used by Mr. Cooke in the construction of the table are placed in the Blue School play-ground; the temperature therefore given as that of Hereford is really that of the Blue School play-ground. As this place is pretty large and well exposed to the north and east winds, the walls being low, I think the situation a good one for instruments intended to show the temperature at Hereford. The thermometer-stand is, however, attached to the walls of the building, an arrangement contrary to rule, but necessary in the present case, and therefore in order to check the indications afforded by these instruments I have placed a set of tested thermometers in my garden, the readings of which are registered every morning and published weekly in the *Hereford Times*.

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According to the Blue School thermometers the mean temperature of 1866 was 49.°3. Mr. Glaisher has determined the average yearly temperature at Greenwich to be 49.°2; the monthly averages being as follows—January 36.9; February 38.7; March 41.7; April 46.2; May 52.9; June 59.1; July 61.8; August 61.2; September 56.6; October 50.2; November 43.2; December 39 8. These averages were deduced from observations taken at Greenwich from 1814 to 1863.

I think we may conclude that the temperature of 1866 was an average temperature.

The rainfall returns as they appear in the table are according to the indications afforded by an eight-inch rain-guage also placed in the Blue School play-grounds.

This rain-guage, the property of the Woolhope Club, is the workmanship of Negretti and Zambra, and has been examined and repaired by them within the last three or four years. The rim of the instrument stands six feet three inches from the ground and is very fairly exposed. From some cause, however, which I cannot explain, the daily measurements are always a little less than mine, and I think there must be an error, though a very slight one, either in the receiver or the glass measure. It will be seen by the table that nearly twenty-six inches of rain fell at Hereford during the past year. This, at least, was the quantity measured at the Blue School. At Stretton the Rev. A. C. Key measured 27.57 inches, and at Tupsley Mr. Ballard measured 26.58 inches. I re-commenced rain measurements at Hereford on the 1st of August, and by comparing my measurements with those taken at the Blue School I am led to believe that the amount given by the latter is a little less than the true quantity, and that at least twenty-seven inches of rain fell at and around the city of Hereford during the year 1866. This amount is nearly the average for Hereford as gathered from measurements made by the late Mr. Lawson during a period of 15 years. The mean of his measurements is 27.145 inches.

Mr. Cook is very careful in keeping daily notes of the direction of the wind, and that part of the table which is devoted to this subject has been drawn up with strict attention to accuracy. We have no means at Hereford of measuring the speed or force of the wind, but I hope some day to see a good anemometer set up here, as observations of this kind are of great practical importance.

Ozone observations ceased suddenly in June, 1866, in consequence of the departure from this neighbourhood of a friend (Mr. Tringham) who had kindly undertaken to manage the ozonometer at his residence at Hampton Park, Eign Hill. This situation is an exceedingly good one for ozone observations. In Hereford it is quite useless to expose ozone test-papers.

Since my return to Hereford I have availed myself of Mr. Davison's kindly offer to place an ozonometer in his nursery gardens. Mr. Davison has attended to the change of papers with great regularity, and the result of our joint work in this department of meteorology has been published weekly in

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the *Hereford Times*. I am happy to add that we have now a prospect of most efficient aid in this branch of observation, the Rev. A. C. Key, of Stretton, having turned his attention to the subject.

With respect to the weather generally during the year 1866, I am not aware that there was anything observed at Hereford worthy of very particular notice. Mr. Cooke has drawn attention, in some notes sent to me, to the mildness of January and February, and states that a thunderstorm occurred on February 4th. He notices "severe frosts" at the commencement of March, and a storm of thunder and lightning on the 18th. May, according to these notes, was a cold ungenial month, but a very dry one. In June two heavy thunderstorms occurred, one on the 1st the other on the 4th. July was dry and hot; the highest temperature in the shade being, according to the table, 85.3. In some places, where the thermometer stands were fully exposed to the sun's rays, the mercury rose still higher. Some heavy rain occurred in August: on the 8th more than half an inch fell in thirty minutes. September was a very wet month.

There were 229 fine days during the year and 136 wet.

The great event of the year, interesting alike to the meteorologist and astronomer, was the grand display of meteors on the night of November 13th-14th. The wind blew in strong squalls at intervals, and clouds, with showers occasionally, caused a partial obstruction of the heavens; but the sight was exceedingly magnificent. From the constellation Leo, as a centre, brilliant rocket-shaped meteors shot out in every direction, and from 1 a.m. until 1.30 the heavens presented a most extraordinary spectacle. Instead, however, of attempting to describe the scene, I shall conclude this paper with a few remarks gathered from more experienced observers and abler writers. "At 1.12 a.m.," says Mr. Symons, "they (*i.e.* the meteors) averaged quite 100 per minute. At this time, the constellation Leo, whence almost all the meteors radiated, was well out of the mist in the horizon, and was dotted with balls of light, with tails so foreshortened that they seemed but elongations of the head, while around, as from a fiery crown, meteors mostly more brilliant than Sirius (which was shining in the west) darted north, south, and west, their bodies mostly white, as the ball of lime in an oxy-hydrogen lamp, their tails always brightest in the middle of the track, and generally invisible close to the head. Several remained visible long enough for the telescope to be turned to them, and careful remarks made on their apparent structure; usually they were much wider in the middle than elsewhere, and on two occasions were observed to bend before they faded from sight; it looked as if they were heavier in the centre, or as if a gust of wind had swept across their track. Most of the trains were tinged with green, but purple and other tints were by no means absent, the resultant beauty, when (as was often the case) two or three differently tinged trains were visible in close proximity, was extreme."—*Meteorological Magazine* for December. Mr. Symons estimates "the total number visible at

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about 7,000 or 8,000." "No person," writes Mr. J. R. Hind, of the Twickenham Observatory, "who carefully watched the display of last night could have any doubt as to the accuracy of the astronomical theory relative to these bodies. The radiant in Leo was most strikingly manifested; while the meteors in the opposite quarter of the sky traversed arcs of many degrees, in the vicinity of the diverging point they shone out for a few seconds without appreciable motion, and might have been momentarily mistaken for stars by any one to whom the configuration of the heavens in that direction was not familiar."

The "astronomical theory" referred to by Mr. Hind is so well given in the following extract from the *Times* that I feel I cannot do better than copy the language of that journal, and give the following passage without note or comment:—"Once in a generation, and thrice in a century—for in this matter man and the material universe seem strangely in accord—this earth has to encounter an immense cloud of stones revolving round the sun, in an orbit of the same size as its own, but in a contrary direction. This cloud of stones is believed to constitute a sort of ring, diffused over the whole orbit, like a great highway of rolling or flying stones, though not in uniform density. However, there is no escaping them, whatever they are, for the breadth of this highway or stream is compared to the moon's orbit, and it takes two or three successive years, or, we should say, successive Novembers, for the earth to enter and clear it. These stones enter our atmosphere with a velocity of forty miles a second, and destroy themselves, as it were, by their own violence, for, when once arrested by our grosser air, they are instantly melted and dissipated in the air."

Professor Grant, of the Royal Observatory, Glasgow, says that the average height of the meteors above the earth's surface has been found to be about seventy miles.

In conclusion, I am anxious to remind the members of the Woolhope Club that their stock of meteorological instruments is not in a very satisfactory condition. The barometer is, it is true, in first-rate order, and the same may be said, I believe, of the electrometer and wind-guage (Lind's); but the rain-guage should be tested, and the thermometers are all partially useless. It is quite true that many of the members possess good instruments; but these instruments, being private property, are liable at any moment to removal at the will of the owners. It is right that a scientific society like the Woolhope Club should, in a matter of this kind, be independent of individual members, and possess instruments which might be made available in any emergency, and render the breaking up of a series of observations by the removal of a member a matter of impossibility.

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METEOROLOGICAL TABLE FOR 1866.

1866.	Bar. Mean Height.	Bar. Highest Readings at 9 a.m.	Bar. Lowest Readings at 9 a.m.	Ther. Average of Maxim.	Ther. Average of Minim.	Ther. Highest Reading	Ther. Lowest Reading	Mean Temp.	Rainfall.	WIND.							
										N.	N.E.	E.	S.E.	S.	SW.	W.	NW.
										days	days	days	days	days	days	days	days
JANUARY	29.619	30.545	28.859	47.51	36.91	54.5	25.0	42.01	2.803	0	0	0	1	3	10	9	1
FEBRUARY	29.487	30.177	28.518	46.87	34.14	54.8	21.0	40.21	2.205	2	0	0	1	2	6	7	5
MARCH	29.495	30.232	28.758	47.81	34.16	64.0	18.0	39.98	2.394	6	2	3	4	2	3	6	4
APRIL	29.735	30.267	29.293	56.30	40.40	72.8	29.2	46.85	1.617	3	2	9	3	4	4	3	0
MAY	29.811	30.190	29.411	61.65	40.26	70.5	28.0	49.26	0.791	2	1	7	3	4	2	5	4
JUNE	29.738	30.061	29.398	71.53	53.57	82.8	40.8	60.75	2.498	0	3	5	2	8	5	3	2
JULY	29.756	30.150	29.156	72.35	53.53	85.3	48.0	61.04	0.696	4	1	4	1	2	4	9	4
AUGUST	29.641	29.960	29.230	68.60	52.30	76.2	43.0	58.75	2.932	0	1	2	0	8	6	9	3
SEPTEMBER	29.505	29.866	29.077	61.83	48.85	69.0	37.0	54.29	5.297	1	0	1	5	8	9	3	2
OCTOBER	29.907	30.339	29.527	57.21	46.28	64.7	30.0	50.74	2.396	5	4	7	3	8	1	0	2
NOVEMBER	29.759	30.071	29.175	51.50	40.14	60.0	28.0	45.42	1.025	0	0	0	1	6	4	11	6
DECEMBER	29.743	30.283	29.078	47.77	37.17	57.0	25.0	42.47	1.244	0	1	2	1	11	7	7	2
	356.196	362.141	349.480	690.93	517.71	811.6	373.0	591.77	25.898	23	15	40	25	66	61	72	35

The Barometer readings are corrected for temperature, capillarity and index error, but not reduced to sea-level. Hereford, according to Mr. Curley, is 158 feet above the level of the sea: the cistern of the barometer is, therefore, about 170 feet above sea-level.—Barometer, mean reading for the year, 29.683 inches. Thermometer, mean reading for the year, 49.31 degrees.

WILLIAM COOKE.

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OZONE AT HAY.

By J. EVANS SMITH, Esq.

From March 4th, 1865, to March 3rd, 1866.

With respect to this report and the tables I herewith lay before you, I will briefly state that, having kept a record of Ozone at Hay for rather more than a year with Dr. Clarke's ozone cage, I thought it advisable to preserve the results, by reducing them to order and depositing them in the archives of our club, where they could be made use of whenever required.

The chief results that I have derived from these observations are the following:—

That the *least* amount of ozone occurs with easterly winds, especially from the northern side. When a north-east wind prevails, there is often no ozone for days together.

The *greatest* amount of ozone occurs with westerly winds, especially from the south-west, and during a tempest or storm from the S.W. the highest numbers are invariably recorded. So regularly do the above phenomena occur, that I generally know the direction of the wind by examining the state of the ozone paper that has been exposed for twelve hours previously.

Unfortunately I did not keep a constant record of the direction of the wind, but I can often supply the omission by other means, except during the months of July and August, January and February.

The winter and spring quarters show the greatest amount registered. The autumn and summer show the least amount. Of the months January shows the highest, September the lowest.

With respect to the prevalence of illness, I have not sufficient facts to lead me to any useful conclusions, but it should be observed that the absence of ozone may produce a greater prevalence of disease, and yet the chief part may be brought under the notice of the medical man when the period of minimum ozone has passed away, and the papers may show an increased amount. Hence it is very difficult to ascertain correctly the effect of ozone on its absence on health. In epidemics I have observed that on a change of wind to N. or N.W., and an increased supply of ozone, the disease has diminished in virulence, and if the state of the weather continues a long time the disease dies out.

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THE ANCIENT MAP IN THE CATHEDRAL LIBRARY.

Sir WILLIAM GUISE called attention to the very interesting old *Mappa Mundi*, in the Cathedral Library, and expressed a hope that something might be done by the Club towards the photographing and publication of this most interesting map. It was probably one of the most ancient in existence, and was so curious and valuable in itself that its publication would be a great service rendered to literature and science. Foreign scholars and foreign governments would, he thought, be glad to possess copies of this valuable map. If it was thought desirable that something should be done by the Club with the view of publishing the map, he should be happy to subscribe £5 towards the expense.

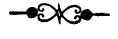
The PRESIDENT-ELECT remarked that he concurred in the wish just expressed by Sir William Guise, and should be happy to add his name to the subscription list. The map was a most interesting and valuable one, and this was especially apparent to any one who had seen the ancient maps preserved in the Vatican and other collections on the Continent. Now that photography was available for the copying of such valuable documents, he certainly thought it should be used in this case. This valuable map was worthy, however, of being reproduced in a line engraving. Except one in the Vatican, he believed it was the most ancient map in existence.

Mr. BLASHILL suggested that the Ordnance Department were constantly making maps, and it would be much better if they could undertake the work. He thought that if Sir Henry James were appealed to, and an offer made of a subscription towards the cost, that the Department might be inclined to undertake it.

Mr. EDMUNDS remarked that Mr. Bannister, formerly Attorney-General of New South Wales, when on a visit to Hereford some years ago, had published a description of the map, with an engraving of part of it.

The PRESIDENT thought that the publication of the map as suggested would be very desirable, especially in the present year, as it would connect the club with archæological pursuits appropriately in the year in which two great Archæological Societies visit the district. In that view, he thought the election of Mr. Hoskyns as President was particularly fortunate from his eminence as an archæologist. The map, however, was under the control, not of the club, but of the Dean and Chapter of the Cathedral. He would suggest that the subject be left to a committee, to consult with the Rev. F. T. Havergal, the Cathedral Librarian, as to the practicability of carrying out the object.

After some further conversation, this suggestion was adopted, and the meeting adjourned.



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THE DINNER

Took place at four o'clock, and was very well served by Mrs. Pritchard. The tables were beautifully decorated with flowers and ornamental plants, most kindly sent for the occasion by Mr. Cranston, of Kings-acre. The attendance was much larger than usual, and included Dr. Bull, the retiring President, in the chair; Chandos Wren Hoskyns, Esq., the President-elect; the Mayor of Hereford, J. F. Symonds, Esq.; Sir William Guise, Bart., President of the Cotswold Club; Rev. W. S. Symonds, President of the Malvern Club; E. Lees, Esq., F.L.S., Vice-President of the Malvern and Worcester Clubs; Rev. H. C. Key and C. G. Martin, Esq., vice-Presidents; Rev. G. H. Cornewall, hon. Secretary of the Woolhope Club; Arthur Armitage, Esq.; Capt. Pateshall, B. Haigh Allen, Esq., Rev. S. Clark, R. M. Lingwood, Esq., James Rankin, Esq, the Rev. Thos. Woodhouse, Rev. W. H. Phillott, Rev. J. H. Jukes, Rev. W. Stillingfleet, Rev. E. Du Buisson, Rev. R. Dixon, Rev. H. T. Mogridge, Rev. J. E. Jones, J. E. Smith, Esq.. Rev. C. J. Westropp, Rev. Thomas Phillips, Rev. T. West, H. Jenkins, Esq., James Davies, Esq., Captain Williams, Thomas Blashill, Esq., Flavell Edmunds, Esq., William Aston, Esq., C. Neate, Esq., T. Curley, Esq., N. S. Wynn, Esq., O. Shellard, Esq., R. D. Harrison, Esq., A. Lomax, Esq., W. J. Bonnor, Esq, F. Thomas, Esq., Mr. G. With, Mr. Arthur Thompson, Mr. H. Edmonds, &c.

On the removal of the cloth, the PRESIDENT commenced the proceedings by a rapid survey of the operations of the club during the past year. One of its first works, he said, had been to bring forward the subject of "The more Remarkable Trees in Herefordshire," for which purpose the following circular had been printed and distributed through the county:—

HEREFORDSHIRE TREES.

It is very desirable—for obvious reasons—that a record should be obtained of the exact size and condition of the MORE REMARKABLE TREES OF HEREFORDSHIRE at the present time. The subject is within the proper field of the Woolhope Club, and it is necessarily so extensive that it can only be done satisfactorily, within a reasonable time, by the mutual co-operation of its members.

The inquiry is intended to embrace, not only the indigenous trees, oak, elm, yew, beech, ash, &c., but also the introduced trees, chestnut, walnut, cedar, and the coniferæ in general, &c.; in short, whatever forest trees are growing in the county that are now remarkable for their size and luxuriance, or that promise hereafter to become so, especially if their exact age is known, and they are in situations where there is every probability of their being allowed to remain.

All members of the club, and all gentlemen who may be interested in the subject, are requested to report on the trees in their several districts, in order that when a sufficient number of facts and observations are obtained, a trustworthy paper may be prepared from them for the Transactions of the club.

The report should contain, first, general observations on the trees which

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are most common and flourish best in the district, the localities in which they grow to the greatest size, and the average size of the several kinds; and secondly, exact measurements and descriptions of all trees remarkable for their size, or from the fact of their exact or approximate age being known.

Lest any should be deterred from making a general report, it is hoped at least all will send a list of all the large trees they are acquainted with, with exact measurements of those in their immediate neighbourhood.

The following examples will show the form in which it is suggested that the reports should be made:—

OAK (or other tree, as the case may be).

1	2	3		4	5
LOCALITY.	Circumference of bole 5ft. from the ground, in feet and inches; and its relative proportion to the height of the tree.	Spread of branches in yards.. N.S.	E.W.	Date of Observation.	Remarks on the age, condition of the tree, cubic feet of timber, &c.
Moccas oak. *Quercus pedunculata.* — Sir Velters Cornewall, Bart., Moccas Park.	35ft. 6in. Remains of the tree, only about 39ft. high altogether.	49.	47.	1866.	This well-known tree is now reduced to a mere shell, hollow from top to bottom. The large limb represented in drawings as broken off and lying beside it as now disappeared, leaving a large irregular opening 6ft. by 9ft. on the east side. The bark on the main trunk is gone, but several branches on the north-west have the bark entire, and still produce leaves and acorns. Loudon makes the girth, at three feet from the ground, 36ft.
Col. Matthews' oak. *Quercus pedunculata.* — F. R. Wegg-Prosser, Esq., Belmont. Near the kitchen garden.	10ft. 2in. Main trunk, 22ft., one-third the height of the tree.	28.	24.	June, 1864.	A well balanced tree, 91 years old. A cast-iron tablet near the tree says, "The acorn was sown at Foxley in 1773, and the sapling planted by John Matthews, Esq., in 1788. The tree measured 5ft. 6in. in circumference in 1813." It now contains 139 feet of timber.

The description of each kind of tree should be on separate papers, for the convenience of immediate arrangement.

The reports, lists, or measurements of trees are requested to be sent to "the Rev. George H. Cornewall, Moccas Rectory, Hereford," honorary secretary to the Woolhope Club.

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The result of the circular had been that they had received a great deal of information, but for that information they were much more indebted to their own members than to gentlemen to whom the circulars had been sent. Their labour, however, had so far resulted in benefit to the club, for it had brought forth an able paper on the Yew-trees of Herefordshire, by Mr. Woodhouse. The Committee had resolved to illustrate this paper with photographs of some of the principal yew trees of the county. Indeed, they had engaged a photographer for the club. It was very desirable that one man should do all that is required, for the sake of uniformity in size and the same focal distance as far as might be. He would fix on the trunk of each tree photographed a piece of cardboard, one foot long by six inches deep, where the circumference was taken, so that by applying a scale carefully to this spot the members could measure for themselves the exact diameter, height, and spread of the tree. It was, in short, another application of the Platœan brick, which had been useful to them on a previous occasion (hear, hear). They hoped to be able, for some years to come, to present to the members pictures of the most remarkable trees of all kinds in the county. This would give great value to their Transactions, and prove a great satisfaction to the members. It was a very expensive matter to produce 150 photographs of each tree, which was the number required for their Transactions, but they had met with most liberal treatment at the hands of Mr. Ladmore. They hoped, therefore, to be able to photograph a limited number of trees every year, and the number must be small unless gentlemen wished to have their trees photographed at their own expense. Major Peyton had kindly offered to present the club photographs of the fine old oaks at Colwall (great applause); and he (the President) hoped other gentlemen might be induced to do the same, so that in course of time they might get together a good collection of the more remarkable trees in the county (hear, hear). The President then exhibited a specimen of the rare southern plant *Xanthium spinosum* (Spiny Burweed or Burdock), and explained that since its discovery at Hereford in 1865, it had again appeared in 1866 in a different locality. No less than 45 plants had come up in the timber yard near the canal in this city. They had appeared on the natural ground amongst the timber trunks, and it was very difficult to explain how the seeds could get there (Dr. Bull then exhibited dried specimens of the plant, which was most remarkable for its long triple thorns projecting in all directions.) If they looked at the plant they would understand the feelings of that worthy friend of his who had told him that it was not an English plant, and he thought it devoutly to be wished that it would never become English (laughter). The Editor of "Sowerby's Plants" had not published an engraving of it, though he noticed its occurrence at Hereford, because it was not likely from its delicacy to become naturalised. The President had therefore resolved that an illustration of it should appear in the Transactions of the club. A pretty lithograph of the Xanthium was then handed round the room. It was very beautifully coloured, and the

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President said he was not allowed to name the ladies who had been so kind as to do this work for him and the club, but he could safely tell them that if they only knew who they were, they would value the picture much more highly (applause). The President then exhibited a specimen of *Erigeron Acris*, the blue fleabane, a plant new to the Hereford district, and which was found near the cemetery wall. Another illustration for the Transactions was also exhibited, a coloured lithograph of an ancient British drinking cup exhumed from the summit of the Worcestershire Beacon in 1849, and now in the possession of Mr. Lees. He then passed on to notice that amongst the good deeds they had done at the annual meeting held that morning, was to elect Mr. Chandos Wren Hoskyns President for the next year, and the Rev. S. Clark, the Rev. Thos. Woodhouse, Humphrey Salwey, Esq., and T. Curley, Esq., Vice-Presidents for the year. These appointments gave a sufficient guarantee for the continued prosperity of the club. He next expressed the gratification he felt at being supported by his friend the Mayor of Hereford, and remarked that there was no one present who had more love of natural history in him than Mr. Symonds. If any of them doubted this, he would advise them to accompany that gentleman in the cool weather of the last week in December or the first week in January in an excursion up the brook Olchon, the river Dore, or Ruckhall brook in search of trouts' nests; but he warned them that if they did not put the same enthusiasm into the work that Mr. Symonds did, they would be sure to catch rheumatism if they did not get trouts' eggs (laughter). He believed Mr. Symonds had hatched and educated more young trout and salmon than any member of the club, and had afterwards turned them into the different streams of the county. He had some trouts' eggs hatching just now and had kindly sent up for some of the baby fish for exhibition to the members. They could not drink the health of the Mayor, because it would be contrary to their rules, but he was sure they would all give him their best thanks for his attendance to-day as chief Magistrate of the city (hear, and applause). They were also favoured with the attendance of several members of neighbouring clubs—Sir Wm. Guise, the president of the Cotswold Club, whom he might call the Nestor of field-clubs for this part of England; the Rev. W. S. Symonds, the president of the Malvern Club, and whose enthusiasm they all knew so well; and Mr. Edwin Lees, the representative of the Worcestershire Club, who throughout the year had rendered them such good service. The only toast he could propose—and it was one which he gave with great pleasure—was "Success to Naturalists' Field-clubs in general, and to the Woolhope Club in particular," connected with the gentlemen whom he had named (applause). In conclusion, the President stated the arrangements of the evening for the reading of papers and for the discussion.

The MAYOR gracefully responded to the kind sentiments expressed by the President, and assured the meeting that it was only the want of time which prevented his devoting more attention to the interesting pursuits in which the club was engaged. [A glass, containing some trouts' eggs and several little fish,

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were exhibited in the course of the evening. Mr. Symonds had obtained them from a little rivulet on the property of Col. Scudamore, of Kentchurch. They had hatched unusually early this year—that is in 72 days instead of from 90 to 100 days, as was more usual. This was probably due to the mild weather that had succeeded January's frost.]

The PRESIDENT-ELECT, after briefly acknowledging the toast, then read the following paper.

A NOTICE ON THE OCCURRENCE OF CROSSBILLS (LOXIA CURVIROSTRIS) BREEDING IN HEREFORDSHIRE.

To the President of the Woolhope Club.

Dear Sir,—I have great pleasure in sending you the following particulars respecting the Crossbills exhibited at Builth.

I have obtained four specimens during the month of August, which were all shot within half a mile of Kington. The first was killed on the 3rd of August, and is evidently a bird of the year, being of small size, with the bill only slightly crossed, and having plumage of a greenish brown with only a slight tinge of yellow on the lower part of the back.

The next I obtained was killed on the 18th of August, and is a female, the whole of the body plumage being tinged with yellow. On the 22nd, I for the first time saw the birds myself, and obtained two males, the body plumage being orange red. There can, I think, be little or no doubt of their having bred in this neighbourhood during the past season, as from the fact of one being a young bird, they could not have migrated from any great distance.

I may state that they were rather numerous, and I therefore hope they may remain and breed here next spring, when I shall do my best to observe their nesting habits and obtain eggs.

The trees they frequent are the Scotch fir and larch, but seem to prefer the former. They are by no means shy birds, and on being shot at will fly but a short distance. They fly from tree to tree with the body carried in a vertical position, but I cannot say anything about their position in a more extended flight.

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I append an extract respecting the changes of plumage in the crossbill, from the late lamented "Old Bushman's" work, "Ten years in Sweden," and from his long experience and careful habits of observation, his remarks may be relied upon.

He says, "With regard to the changes of plumage in the crossbills, the following statements are the results of several years observations.

"The first dress, which is changed at the first autumnal moult, is greenish-brown in both sexes, longitudinally streaked with darker brown, in fact very like the nest plumage. After the first autumnal moult, the body plumage is much the same, but all the under parts are tinged in the young males with yellow-orange. In the females much brighter yellow. In the young males, the heads and rumps are orange; in the females only tinged with yellow. The striped feathers of the young are very apparent on both all through the winter and following spring. They breed in this dress, which I fancy lasts them for one whole year.

"I never saw the slightest indication that the plumage of the male would become red until the next moult, and I think this does not take place till the following autumn, and that then it will not be deep red, but orange yellow-red, for we find this colour in the birds breeding in this dress in February and March, although I believe a change in plumage may take place in May. It is clear that the bird does not become red at once, because these orange-red breasts are not birds of the previous year, at least those which we find breeding in March. I am of opinion that the full red dress is not assumed until the third autumnal moult, and the males breed in two intermediate stages of plumage before it is resumed; because we find in the same forest, and at the same time, the males breeding in all these three stages of plumage. In the summer, the red dress of the male crossbill seems to become darker.

"The nest is coarsely built of sticks, lined with moss and grass, and is placed on the top of a small pine, very rarely on a fir, and never in the depth of the forest, but always in a strong rise where the trees are small, and stand wide apart.

"The eggs, three, much resemble those of the green linnet, but are larger."

Hoping these particulars will be of service for publication in the Transactions of your Club,

I beg to remain, yours faithfully,

JAMES W. LLOYD.

In a short discussion which followed, the Rev. G. H. CORNEWALL said that the fact of Crossbills visiting the county had been noticed before, but he did not think any such proofs of their having bred here had ever been offered before. The Rev. Mr. Crouch, of Pembridge, had three very fine specimens in a glass case, which had been shot in his own garden in October. Mr. Crouch would have sent them to this meeting but for the difficulty of carriage.

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Mr. LEES doubted their being bred here. He stated that he had read in an old history of birds called Crossbills that formerly visited Herefordshire, in the autumn, in great numbers, and did much damage to the apples in the orchards by cutting them up with their crooked bills.

Dr. BULL said that Mr. Lloyd had written to inform him that the Crossbills had been seen again at Kington a fortnight ago, and thus it was clear that they had been observed in the county at three different periods of the year, in February, the beginning of August, and October. Mr. F. Symonds, the Mayor's son, had shot a couple near Hereford last autumn. These observations seemed to show that Crossbills were more common here than was believed. He had seen lately a couple of those fine birds, the Hawfinches, which had been shot at Thruxton. He thought there was an ample field for ornithological observations, in the more wooded parts of the county. They must all thank Mr. Lloyd for his paper, in which the fact of the Crossbills breeding in the county was almost proved, and he hoped that next year he would be able to tell them he had again seen the birds, that he had found their nest and eggs, observed their habits, and let the young ones fly, for it was rather painful to hear of their being always shot. He was sure Mr. Lloyd could not shoot them all (hear, hear). The club would be very glad to have another paper from him on the subject at their autumn meeting.

THE CAVES IN THE GREAT DOWARD HILL.

By Sir WILLIAM GUISE, Bart., F.G.S., &c.

Before introducing this subject, Sir WILLIAM GUISE said he had great pleasure, on the part of the Cotswold Club, in acknowledging the toast which had been proposed by the President. The Cotswold Club, with one single exception, was the senior club in this country; and it was very satisfactory to him as an old field-club man, to see the Woolhope Club in so excellent a position (hear, hear);—under the presidency of Dr. Bull, indeed, its position could not be other than satisfactory and efficient (hear, hear). Looking at field clubs not only in their scientific and educational aspect, but in their social aspect, as at that moment, he felt that they were calculated to do a great deal of good. In the present day education seemed to be progressing, and he believed that field clubs were powerful instruments for aiding on the spread of education (hear, hear). With regard to the Doward caves, it was a question which opened up such a vast field of inquiry, that if he were to go into it in

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detail he should take up a much larger portion of their time than they were prepared to surrender to him. He could therefore only briefly touch upon it. They were all aware, from papers which had been published, how Mr. Symonds and he had gone to Belgium—how by the reading of certain papers before the Cotswold and Woolhope Clubs they had got themselves into a scrape—how a London gentleman had written in a very angry and improper manner, and how they had demolished their antagonist and set matters right (hear and laughter). They were led to believe, from what they saw in Belgium, that similar things might be found along the line of the Wye in the carboniferous limestone strata. Dr. Dupont was the first who had introduced anything like a systematic investigation into the cave phenomena, and he had found that these were traceable to three distinct deposits in these caves. Investigations had been made at the caves of Torquay, and it struck Mr. Symonds and himself that on examination of the fissures in the Wye valley they might come upon analogous conditions. They had not done this, however, but they had come upon a regular earthman, known by the name of "Jim the Slipper" (laughter), who had for 30 years lived, he might say, in a hole in the ground with "his old woman," as he called his wife, both arrayed in loose and ragged costumes. They had to creep on their hands and knees to get to his "habitation," and the quiet self-possession with which he handed them to seats—blocks of stone—was something quite marvellous (hear and laughter). They examined some 15 caves, but in none did they find anything to lead them to believe that their conditions were analogous to those of the caves in the Lesse valley. In one cave they found a quantity of bones, but they were only the remnants of the exploits of deer and sheep-stealers. In examining the caves of the Great Doward, however, they fell in with a civil engineer who was surveying a line of railway from Ross to Monmouth, and who told them that a large cave had been broken into in which there were cart loads of bones. No attention at the time was paid to the discovery, and it did not strike the men to make any researches among the bones, and it was too late now to inquire about them. The investigation had not yet been fully worked out; but as the carboniferous limestone rocks were perfectly full of fissures, and as he was inclined to believe that they were analogous to those in the Lesse valley, he thought that a more complete investigation might lead to some important discoveries in the caves of the Wye Valley (hear, hear, and applause).

The Rev. W. S. SYMONDS, after paying a high compliment to the Woolhope Club for its management during the past year, which he had never seen surpassed at the meetings of any club, read the following paper for the President.

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HEREFORDSHIRE LEPIDOPTERA.

(Communicated by the PRESIDENT).

The following list of Herefordshire Lepidoptera has been kindly prepared for the Club by the family of the Rev. Thos. Hutchinson, M.A., of Grantsfield, near Leominster, for that district of the county; and by Mr. Alfred Purchas for the Ross district. On forwarding the list lately to Mr. Hutchinson for revision, it was returned with a letter, which seemed to me so interesting that I have asked permission to read some passages from it to the Club:—

"You will perceive that we were not idle last season, and were rewarded by taking no less than 48 new species in the county. Our captures were not confined entirely to this immediate neighbourhood. Several species new to us were taken on Dinmore-hill, a place we visited many times during the summer. The somewhat local *Lithosia Grisiola* was taken at Lugwardine. There can be no doubt that many new species will still reward patient research.

"Of the 48 species mentioned above, 23 are *Tortrices*. We have only lately attacked these. They are far more difficult than the *Macro-Lepidoptera*.

"The *Tineæ* are still a 'closed book' to us all, and yet their exceeding beauty makes us long to understand them. The county is probably rich in this most extensive group, which contains above 650 species in itself. In 1865 we had the good fortune to take an example of one of them, *Cerostoma Asperella*, of which only six British specimens had before been recorded. These were all taken at Glan-Wootton, Dorset, above forty years ago, five by the great entomologist, Mr. Dale, and one by his friend, Mr. Curtis. Mr. Dale favoured us with all the particulars. The specimen we captured is now honoured with a place in Mr. Doubleday's collection.

"Besides Imagos, last season, our eldest son Tom took a large number of *Larvæ*. Two exceedingly rare ones, *Dicranura Bicuspis* and *Acronycta Alni*, the latter was injured when found and died. There is a faint hope that *D. Bicuspis* will yet emerge, but this cocoon met with an untoward accident and the pupa may have been injured. We have not ventured to mark either, and yet we are as sure of them, as if we had the Imagos. Tom we hope will become a really good naturalist. The ease with which he finds larvæ and his power of knowing insects on the wing by the slightest peculiarity in their mode of flying is very surprising. He is the great taker of our treasures, but a few fall also to the other children, and all are equally fond of the study."

The second letter, which gave me permission to read this one to you, says in addition :—

"It may be well to furnish you with one or two further particulars, lest any entomologist present at the meeting should consider 'Mr. Hutchinson's family' are given to name species too freely. Whenever we take a *rare* species, or one not likely to occur here, we always place it in the hands of one of our first entomologists, so as to be quite sure that we have named it correctly. Should any one, therefore, express surprise that *Hepialus velléda*, *Melanippe*

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Tristata, or *Xanthia Gilvago*, or *Plusia Bractea*, should be taken so far south, you may say, please, that they were sent to the Rev. Joseph Greene for confirmation, whose skill is beyond dispute. Only one example of each has been taken here, but a second of *Melanippe Tristata* was taken at Stanner last June, when you kindly invited Tom to join the Woolhope Club for the excursion there."

"*Eupithecia Consignata* is so rare that when an account of its occurring here was published in the "Entomologist," many persons wrote to us respecting it. You may state, please, that we have sent a *living* specimen to both the Rev. J. Greene and to the Rev. Harper Crewe (in the hope that, under their skilful management, eggs might be obtained, and the species reared, but neither were successful). We take them at *rest* on apple-trees between the 25th of April and the 2nd of May. All our names are verified by Mr. Doubleday, or some other skilful person."

"*Agrostis cinerea* came to light last summer."

"The two rare larva mentioned before—the *Dicranura Bicuspis* and *Acronycta Alni*—rest on our authority; the latter is known to have occurred at Worcester, and some years ago the late Rev. J. J. Miller found a larva of it at Sapey Bridge, which he showed us."

"Our *D. Bicuspis* was taken on alder, at Dinmore Hill, and in confinement it fed also on birch. It was the most beautiful larva we ever had, rather larger than *D. bifida*, with which we were able to compare it accurately, for we had several feeding at the same time. The dorsal stripe in *Bicuspis* was bright violet, where *Bifida* was brown, and the lines which in the latter species were yellow, in *Bicuspis* were quite golden. The extreme irritability evinced by the larva at feeding time, also far exceeded that shown by the other *Dicranuræ*."

Dr. BULL then introduced the following list of insects, and said that it was a great gratification to the club to have so good a list for their Transactions, and to know that they had such excellent practical entomologists in the county.

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HEREFORDSHIRE LEPIDOPTERA,

IN THE LEOMINSTER AND ROSS DISTRICTS.

Omitting Tineæ except Epigraphidæ and Psychidæ.

(The Arrangement and Nomenclature as adopted by Doubleday from Guinée.)

For Synonyms see H. Doubleday's Synonymic List. 2nd Ed., 1859.

When not marked the species occurs in both Districts; when only in one of them, Leominster is thus marked "..."; Ross thus "—"

DIURNI.

LEUCOPHASIA
Sinapis
PIERIS
... Cratægi
Brassicæ
Rapæ
Napi
ANTHOCHARIS
Cardamines
GONEPTERYX
Rhamni
COLIAS
... Edusa
... Helice
ARGYNNIS
Paphia
... Aglaja
... Adippe
Euphrosyne
... Selene
MELITÆA
... Artemis
VANESSA
C-Album
Urticæ
Polychloros
Io
Atalanta
Cardui
SATYRUS
Ægeria
Megæra
— Semele
Janira
Tithonus
Hyperanthus
CHORTOBIUS
Pamphilus
THECLA
Rubi
Quercus
W-Album
POLYOMMATUS
Phlæas
LYCÆNA
... Agestis
Alexis
Argiolus
SYRICTHUS
Alveolus
THANAOS
Tages
HESPERIA
Sylvanus
... Linea

NOCTURNI.

SMERINTHUS
Ocellatus
P. puli
Tiliæ
ACHERONTIA
Atropos
SPHINX
... Convolvuli
Ligustri
CHÆROCAMPA
... Porcellus
Elpenor
MACROGLOSSA
Stellatarum
... Bombyliformis
SESIA
— Tipuliformis
ZEUZERA
... Æsculi
COSSUS
Ligniperda
HEPIALUS
Hectus
... Lupulinus
Sylvinus
... Velleda
Humuli
PROCRIS
... Statices
ZYGÆNA
... Trifolii
... Loniceræ
Filipendulæ
NOLA
... Cucullatella
... Cristulalis
NUDARIA
Mundana
LITHOSIA
Complanula
... Griseola
— Rubricollis
EUCHELIA
Jacobeæ
CHELONIA
Caja
ARCTIA
Fuliginosa
Mendica
Lubricipeda
Menthastri
LIPARIS
... Aurifua
— Monacha
ORGYIA
Pudibunda
Antiqua
DEMAS
... Coryli
TRICHIURA
... Cratægi
PŒCILOCAMPA
... Populi
ERIOGASTER
Lanestris
BOMBYX
Neustria
Rubi
Quercus
ODONESTIS
Potatoria
LASIOCAMPA
— Quercifolia
SATURNIA
... Carpini

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GEOMETRÆ.

OURAPTERYX
Sambucata
EPIONE
... Apiciaria
— Advenaria
RUMIA
Cratægata
VENILIA
Maculata
ANGERONA
— Prunaria
METROCAMPA
... Margaritata
ELLOPIA
... Fasciaria
EURYMENE
Dolobraria
PERICALLIA
Syringaria
SELENIA
Illunaria
... Lunaria
... Illustraria
ODONTOPERA
... Bidentata
CROCALLIS
Elinguaria
ENNOMOS
... Tiliaria
... Fuscantaria
Angularia
HIMERA
Pennaria
PHIGALIA
... Pilosaria
AMPHYDASIS
Prodromaria
Betularia
HEMEROPHILA
Abruptaria
CLEORA
Lichenaria
BOARMIA
Repandata
... Rhomboidaria
TEPHROSIA
— Crepuscularia
... Punctulata
GEOMETRA
Papilionaria
IODIS
Lactearia
HEMITHEA
... Thymiaria
EPHYRA
— Omicronaria
... Pendularia
HYRIA
— Auroraria
ASTHENA
Luteata
Candidata
EUPISTERIA
... Heparata

ACIDALIA
... Scutulata
... Bisetata
... Immutata
... Remutata
Imitaria
Aversata
... Emarginata
TIMANDRA
Amataria
CABERA
Pusaria
... Exanthemaria
HALIA
Wavaria
PANAGRA
Petraria
NUMERIA
Pulveraria
FIDONIA
Atomaria
... Pinaria
MINOA
Euphorbiata
ABRAXAS
Grossulariata
LIGDIA
Adustata
LOMASPILIS
Marginata
HYBERNIA
Rupicapraria
... Leucophearia
Progemmaria
Defoliaria
ANISOPTERYX
Æscularia
CHEIMATOBIA
Brumata
OPORABIA
Dilutata
LARENTIA
Didymata
... Multistrigaria
— Olivata
... Pectinitaria
EMMELESIA
... Affinitata
Alchemillata
... Albulata
Decolorata
EUPITHECIA
... Consignata
... Centaureata
... Succenturiata
... Subfulvata
... Castigata
... Fraxinata
... Indigata
... Nanata
... Subnotata
... Vulgata
... Absynthiata
... Assimilata

... Dodoneata
... Abbreviata
... Exiguata
... Pumilata
... Ceronata
... Rectangulata
LOBOPHORA
... Sexalata
... Hexapterata
... Lobulata
THERA
... Variata
YPSIPETES
... Ruberata
... Impluviata
... Elutata
MELANTHIA
... Rubiginata
... Ocellata
MELANIPPE
... Hastata
... Tristata
... Unangulata
... Subtristata
... Montanata
... Galiata
... Fluctuata
ANTICLEA
... Badiata
... Derivata
COREMIA
... Propugnata
... Ferrugata
CAMPTOGRAMMA
... Bilineata
SCOTOSIA
Dubitata
... Undulata
CIDARIA
... Psittacata
... Miata
... Corylata
... Russata
Immanata
... Suffumata
... Silaceata
Prunata
... Testata
Fulvata
Pyraliata
... Dotata
EUBOLIA
... Cervinaria
Mensuraria
... Palumbaria
— Bipunctaria
ANAITIS
Plagiata
CHESIAS
... Spartiata
TANAGRA
... Chærophyllata

DREPANULÆ.

PLATYPTERYX
... Lacertula

... Falcula
... Hamula

CILIX
... Spinula

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PSEUDO-BOMBYCES.

DICRANURA
... Furcula
... Bifida
Vinula
STAUROPUS
... Fagi
PETASIA
... Cassinea

THYATIRA
Derasa
Batis
CYMATOPHORA
... Duplaris
... Fluctuosa
— Diluta
... Ocularis
... Flavicornis
BRYOPHILA
Perla
ACRONYCTA
Psi
... Leporina
... Megacephala
... Ligustri
Rumicis
LEUCANIA
... Conigera
Lithargyria
Comma
Impura
Pallens
GORTYNA
... Flavago
HYDRÆCIA
... Nictitans
... Micacea
AXYLIA
... Putris
XYLOPHASIA
... Rurea
Lithoxylea
... Sublustris
Polyodon
Hepatica
HELIOPHOBUS
Popularis
— Hispida
CHARÆAS
... Graminis
LUPERINA
... Cespitis
MAMESTRA
... Anceps
... Furva
Brassicæ
APAMEA
... Basilinea
... Gemina
Oculea
MIANA
Strigilis
... Literosa
... Arcuosa
GRAMMESIA
Trilinea
CARADRINA
... Morpheus
... Alsines
... Blanda
Cubicularis
AGROTIS
... Suffusa
Segetum

PYGÆRA
Bucephala
CLOSTERA
... Curtula
PTILODONTIS
... Palpina
NOTODONTA
... Camelina

NOCTUÆ.

Exclamationis
... Cinerea
— Cursoria
— Tritici
— Ravida
TRIPHÆNA
Janthina
... Interjecta
Orbona
Pronuba
NOCTUA
... Augur
... Plecta
... C-Nigrum
... Triangulum
... Brunnea
Festiva
Rubi
... Umbrosa
... Baja
Xanthographa
TRACHEA
... Piniperda
TÆNIOCAMPA
Gothica
... Leucographa
... Rubricosa
Instabilis
... Opima
... Populeti
... Stabilis
... Gracilis
... Miniosa
... Munda
Cruda
ORTHOSIA
... Ypsilon
... Lota
... Macilenta
ANCHOCELIS
... Rufina
Pistacina
... Litura
CERASTIS
Vaccinii
Spadicea
SCOPELOSOMA
Satellitia
XANTHIA
— Citrago
... Cerago
... Silago
... Aurago
... Gilvago
... Ferruginea
TETHEA
... Subtusa
COSMIA
Trapezina
... Pyralina
... Diffinis
Affinis
DIANTHÆCIA
Capsincola
... Cucubali
Dictæa
... Dromedarius
Zicsac
... Trepida
... Chaonia
DILOBA
Cæruleocephala

POLIA
... Chi
EPUNDA
Viminalis
MISELIA
... Oxyacanthæ
AGRIOPIS
Aprilina
PHLOGOPHORA
Meticulosa
EUPLEXIA
Lucipara
APLECTA
Nebulosa
HADENA
... Adusta
... Protea
Dentina
Suasa
Oleracea
... Pisi
... Thalassina
... Genistæ
XYLOCAMPA
... Lithoriza
CALOCAMPA
... Exoleta
XYLINA
Rhizolitha
... Semibrunnea
... Petrificata
CUCULLIA
Verbasci
... Scrophulariæ
Umbratica
HELIOTHIS
... Armigera
HELIODES
... Arbuti
BREPHOS
... Notha
ABROSTOLA
... Urticæ
... Triplasia
PLUSIA
Chrysitis
... Bractea
... Festucæ
Iota
... V-Aureum
Gamma
GONOPTERA
Libatrix
AMPHIPYRA
Pyramidea
... Tragopogonis
MANIA
Typica
Maura
CATOCALA
Nupta
EUCLIDIA
... Mi
... Glyphica

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DELTOIDES.

HYPENA
Proboscidalis
... Rostralis

RIVULA
... Sericealis

HERMINIA
... Barbalis
... Tarsipennalis
... Griscalis

AVENTLÆ.

AVENTIA
... Flexula

PYRALIDES.

PYRALIS
Farinalis
AGLOSSA
Pinguinalis
PYRAUSTA
... Purpuralis
HERBULA
... Cespitalis
CATACLYSTA
Lemnalis
PARAPONYX
— Stratiotalis
HYDROCAMPA
Nymphæalis

Stagnalis
BOTYS
... Pandalis
Verticalis
... Fuscalis
Urticalis
EBULEA
... Crocealis
PIONEA
Forficalis
— Stramentalis
SCOPULA
... Lutealis

Olivalis
... Prunalis
... Ferrugalis
STENOPTERYX
... Hybridalis
SCOPARIA
... Ambigualis
... Cembralis
... Pyralalis
... Mercurialis
... Cratægalis
... Resinalis
... Truncicolalis

CRAMBITES.

CRAMBUS
Falsellus
... Pratellus
... Pascuellus
... Perlellus
— Warringtonellus

Selaselius
... Tristellus
Culmellus
... Hortuellus
PHYCIS
... Betuella

RHODOPHÆA
... Advenella
MELIA
... Sociella

TORTRICES.

HALIAS
Prasinana
... Quercana
SARROTHRIPA
... Revayana
TORTRIX
... Pyrastrana
... Xylosteana
— Sorbiana
... Rosana
... Heparana
... Ribeana
... Unifasciana
Viridana
... Ministrana
... Adjunctana
DICHELIA
... Grotiana
LEPTOGRAMMA
Literana
PERONEA
Favillaceana
... Schalleriana
... Variegana
... Cristana
... Hastiana
... Umbrana
TERAS
... Caudana
... Contaminana
DICTYOPTERYX
... Lœflingiana
... Bergmanniana
... Forskaleana
ARGYROTOZA
... Conwayana
PTYCHOLOMA
... Lecheana

DITULA
... Semifasciana
PENTHINA
Betulætana
... Ochroleucana
... Cynosbana
ANTITHESIA
... Salicana
SPILONOTA
... Ocellana
— Acerriana
... Dealbana
... Roborana
PARDIA
... Tripunctana
ASPIS
... Udmanniana
SERICORIS
... Lacunana
ROXANA
... Arcuana
CNEPHASIA
... Musculana
SCIAPHILA
... Hybridana
BACTRA
... Lanceolana
PHOXOPTERYX
... Lundana
GRAPHOLITA
... Paykulliana
... Nisana
... Campoliliana
PHLÆODES
... Immundana
PŒDISCA
... Bilunana
... Oppressana

... Corticana
... Ophthalmicana
... Occultana
... Solandriana
EPHIPPIPHORA
... Bimaculana
... Scutulana
... Brunnichiana
SEMASIA
... Wœberana
COCCYX
... Argyrana
CARPOCAPSA
... Splendana
DICROBAMPHA
... Saturnana
... Plumbagana
PYRODES
... Rheediana
CATOPTRIA
... Ulicetana
... Hypericana
XYLOPODA
... Fabriciana
... Pariana
EUPŒCILIA
... Maculosana
... Ruficiliana
XANTHOSETIA
Zoegana
Hamana
CHROSIS
... Tesserana
ARGYROLEPIA
... Baumanniana
TORTRICODES
... Hyemana

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TINEÆ (part of)

LEMNATOPHILA
... Phryganella
... Salicella

EXAPATE
... Gelatella

DIURNEA
... Fagella

EPIGRAPHIA
... Steinkellneriella

PTEROPHORI.

PTEROPHORUS
... Trigonodactylus
... Acanthodactylus
... Punctidactylus
... Phœodactylus

... Bipunctidactylus
... Fuscodactylus
... Pterodactylus
... Galactodactylus

... Tetradactylus
... Pentadactylus

ALUCITA
... Polydactyla

HEREFORDSHIRE TINEÆ,

OBTAINED IN THE NEIGHBOURHOOD OF LEOMINSTER.

(Named from Stainton's Manual.)

Tinea Tapetzella
Incurvaria Pectinea
Nemophora Swammerdammella
,, Pilella
Adela Fibulella
,, Degeerella
,, Viridella
Swammerdamia Apicella
Yponomeuta Padellus
,, Evonymellus

Prays Curtisellus
Cerostoma Sequella
,, Vittella
,, Radiatella
,, Asperella
,, Xylostella
Phibalocera Quercana
Depressaria Liturella
,, Arenella
,, Alstrœmeriana
,, Ocellana

Depressaria Applana
,, Albipunctella
,, Chærophylli
Gelechia Populella
,, Rhombella
,, Tœniolella
Harpella Geoffrella
Dasycera Sulphurella
Endrosis Fenestrella
Gracilaria Elongella
Ornix Guttea

Dr. BULL then called upon the Rev. H. C. Key, who introduced the following discussion.

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THE RELATIVE VALUE OF THE TWO SPECIES OF BRITISH OAKS,

KNOWN AS QUERCUS SESSILIFLORA AND Q. PEDUNCULATA.

The Rev. H. C. KEY, who spoke in so low a tone that his remarks were very indistinctly heard, said, so far as we could understand him, that the *Q. sessiliflora* is found in much greater abundance in Lancashire and the North than in the South of England, and that the great reasons for holding it to be superior to the *Q. pedunculata* are—that it is more ornamental, that it is of more rapid growth, that it produces the longest and straightest trees and the greatest quantity of timber, and that its wood is the most durable. The question was a very interesting one, and if it were true, as he had stated in his paper, that the rate of growth of the *Q. sessiliflora*, relatively to the growth of *Q. pedunculata*, is as 5 to 4, and the quantity of timber produced as 3 to 2, then it became very important which of the two kinds should be selected for general cultivation.

The PRESIDENT having enumerated the four points taken up by Mr. Key, so as to ensure their distinct consideration, and reminding the speakers that only eight minutes could be allowed each, called upon

Mr. LEES, who said the question of the relative value of the two species of oak—if they were two species—was not of so much importance now as in the days when our ships were "hearts of oak," but it was still of importance in reference to building purposes. The question resolved itself into this—whether there were two species of British oak at all. Many botanists maintain that there is only one, *Q. robur*, and that *Q. sessiliflora* is only a variety of the original *robur*. If that were so, all the qualities for which British oak got credit must be ascribed to *Q. robur*. There were comparatively but few *sessiliflora* to be found, in proportion to *Q. pedunculata*, and he (Mr. L.) disputed the notion of Mr. Key, that they had been cut down for their excellence, as in former times the difference between them was unnoted. Mr. Lees here read the following paper on the subject:—

With regard to the supposed two kinds of British oaks, Selby, who may be considered an impartial judge, thus refers to *Quercus pedunculata* and *Q. sessiliflora*, considered by many botanists as two distinct species, included by Linnæus under the name of *Q. robur*:—

"Our own impression, however, is that they are rather to be considered varieties than species, and this supposition we think is strengthened by the fact that intermediate forms, both in regard to the position of the fruit and the form of the leaves, are frequently met with, and these are found to run so much into each other, and sometimes to partake so equally of the characters of both kinds, as to render it difficult to determine to which they show the

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greatest affinity, thus connecting by gradual approaches the two supposed species, however distinct each may appear when viewed in its typical form, or where the variation is at its maximum. We may add that in the general form, outline, and dimensions of the two trees, when arrived at maturity no striking or marked difference is perceptible, and though the quality of the sessile-flowering kind is said to be inferior in strength and durability to that of the pedunculated, it is used indiscriminately with the latter by workmen for all purposes to which oak timber is applicable, and even in ship-building the one is used in common with the other."—*Selby, British Forest Trees*, 8vo., pp. 241-2.

I might add to this that all the most remarkable old trees of the oak that I have examined are certainly *Q. pedunculata*.

Selby further says, in regard to timber, that "there are various opinions, some having considered that of *Q. sessiliflora* inferior both in strength, toughness, and durability to that of *Q. pedunculata*, while others estimate their relative properties to be nearly upon a par; that the latter is the more correct opinion of the two appears to be established from the comparative trials and experiments that have been made, which show that in strength, elasticity, and toughness, the wood of *Q. sessiliflora* is fully equal, if not superior, to *Q. pedunculata*.

He finally concludes that "Our own opinion is that there is not any such material difference between the qualities of the timber of the two trees as has been asserted by some, but that inferior timber is occasionally produced by each variety—the result, perhaps, of some original constitutional defect, or arising from the nature of the soil, situation, or other local peculiarities of the ground upon which the timber has been raised. Such at least is the result of our own experience, as we have met with oak of the pedunculated kind with timber possessing all the inferior qualities attributed to and supposed to be possessed exclusively by *Q. sessiliflora*."

Mr. Lees added that many remarkable and celebrated oaks which he had examined were more than 800 years old, and that they all proved to be *Q. pedunculata*. It seemed, therefore, extraordinary that all the sessile-flowering oaks should have been cut down, because he didn't think that in former times, even as late as Henry the Eighth's reign, the difference was known. Selby and other authorities also said there was much difference of opinion entertained as to the strength and durability of the two kinds. His own opinion was that the difference in the durability of oak depended in a great measure upon the soil and situation in which the trees grew (hear, hear). [The President here intimated that time was up, and Mr. Lees resumed his seat.]

Mr. Lingwood next rose and said there were many *sessiliflora* about the Mynde estate and at Pengethley and in the western parts of the county, but not in equal proportion to the *pedunculata*; they were always more stunted in their growth, and he could generally recognise them for this very reason.

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The Rev. G. H. CORNEWALL thought that many of the finest oaks which were to be found in the county were certainly *sessiliflora*. The roofs of many of our oldest buildings, as at Chester and in Westminster Abbey, were *sessiliflora*. The *sessiliflora* might grow faster than the *pedunculata*, but he would not go so far as to say that it grew taller.

Mr. THOMAS BLASHILL said: It is very well known that figures are even more deceptive than facts, and, of all figures, those derived from experiment are liable to be the most deceptive; for though the experiment may be worth nothing at all, the figures come upon us with a force which no other kind of evidence can have. This is very much the case with respect to this old subject of controversy, which has been cropping up in one form or another for something like two centuries—from Evelyn's time at least—and which Mr. Key has very usefully revived in such a shape that we can discuss it. It is indeed of interest in a literary much more than in a practical point of view, for practical experience has long since—I believe always—been decidedly in favour of *Quercus pedunculata*. There is this feature in what has been written: hardly anyone goes the length of stating that he knows of his own knowledge anything about his subject, but when one considers the difficulty of arriving at any experimental knowledge of this matter, this is not so very extraordinary; and it is not surprising that botanical and other writers should be content to copy what has been previously written without any testing of the statements, and often without acknowledging the source from which they have copied, so that one is led to take that for a new and confirmatory opinion which is only the repetition of an old one. Nearly a hundred years since the Hon. Daines Barrington was labouring to prove that much of the old timber which had long been considered to be chestnut was really a variety of oak, and this narrowed the question to its present form of the comparative value of the two varieties. Mr. Key has well shown the random manner in which writers have treated this subject, and I am only going one step further than he goes if I suggest that we put aside the authors he has quoted, as well as those whom he has neglected, for they contradict each other, and also themselves, in a manner that is rather confusing, as to the idea that all examples of timber older than the middle of the sixteenth century are of *sessiliflora* oak, including that found in the Irish bogs and in the piles of old London bridge. I can only say that if there is the least truth in the test furnished by the medullary rays, very nearly all our old timber must be *pedunculata*. If not so, why should such curiosity be excited by a reputed case of the use of chestnut or *sessiliflora* oak? When some alterations were being made in the roof of Westminster Hall, about 20 years since, the carpenters were all alive about the wood, and bets were won on the question whether it was oak or chestnut. Going further back, Daines Barrington says he heard a wager laid as to some reputed chestnut timber found in an old house in Chancery-lane, which proves its rarity. I have specimens from many churches full of the cross-grain, which is so feebly developed in *sessiliflora*

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oak. And although, since I have heard Mr. Key's paper read, I have examined all the old oak that I met with, both in this country and in France, I have not seen by chance anything that looked like a piece of *sessiliflora*. A piece of one of the piles of old London Bridge is preserved in the library at Guildhall; it is as black as ink, and of the texture of horn; it is full of the medullary rays; and upon examining a piece of Irish bog-oak, I find them equally plentiful in it. [Specimens of old oak from various churches in Herefordshire, Gloucestershire, Essex, and Norfolk, of the 14th and 15th century, are exhibited to illustrate these remarks.] The fact is, that the great durability of oak used in olden times is the result of careful selection, felling, seasoning, and converting, and not of any peculiarity in the species—for it would be difficult to find a piece of oak originally sound and kept well exposed to the air that had seriously decayed. Damp is a greater enemy than wet, and if timber is kept under close-boarded floors, or ceiled over in not over weather-tight church roofs, it will go, whatever may be its species. A piece of an oak rood screen, here, of the 15th century, is now as sound as at first, and much harder than new oak, and it is 400 years old. Since I heard that this subject was coming on for discussion, I have asked a few friends, who are good observers, what they knew about the question. Singularly, the first evidence I had of *sessiliflora* oak was from the Eastern Counties, where Mr. Key believes it to be now extinct. Mr. R. M. Phipson, F.S.A. (of Norwich), writes me thus:—

"What I am aware of is this: There are two sorts of oak grown in East Anglia. One a broad-leaved one, which is very plain and straight in the grain, and is called by workmen 'bastard oak.' The other is a much harder and better wood, with very jagged leaves, and very full of 'figure,' often quite as much so as the best wainscot, and is known as 'old English oak' by mechanics. Both were certainly used in our old church roofs, but the latter (that is *pedunculata*) by far the most extensively—probably as 5 to 1."

A member of the Severn Valley Club, (the Rev. W. Purton,) writes thus:—

"I have asked two carpenters here about the varieties of oak timber. They recognise 'common' and 'bastard' oak, the latter having very little flower, and resembling chestnut in the grain. This is worth 6d. a foot for 1-inch boards, while the common oak fetches 1s. Of course they know nothing of the botanical differences between the two trees, and seem to think that the bastard oak is only the common oak of inferior quality growing in hedgerows, &c. They admit, however, that all the oak in Bewdley forest is of the 'bastard' kind, and I know that it is almost entirely *sessiliflora*."

It is to me utterly beyond belief that at any time the preference for *sessiliflora* oak—even had it ever existed—could have reduced its quantity as we now see it, for gnarled and coarse trees—quite useless as timber—would be still equal to the increase of their species. I believe further that such an entire change in opinion amongst workmen could not have taken place without leaving some record or tradition at least to mark it. What is the great advantage of oak over all other timber in respect of its strength apart from durability? It is not its great resistance to compression or tension in the direction of its fibres, but in its great power of resisting strains, which cross the line of its fibres. The old Gothic roofs were constructed in dependence upon the property of the wood (although, singularly, the *sessiliflora* roof of Westminster

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Hall is quite an exceptional case), which depends more upon the arched construction of its ribs than upon their resistance to cross-strain. Roof principals were usually framed in triangular form, held together by pins, and it is only necessary to look at the way in which the medullary plates lie in respect of the line of strain to see if they cannot, even if they are as weak as is supposed, be of material disadvantage, while, if they are tolerably strong, they will be of great advantage to the wood. This latter seems to be the French view, for the cross-grain is known as the *maille*, *i.e.*, "the stitch," from the idea that it holds and gives solidity to the other grain. When we are asked to conclude that it weakens the wood by separating it into sections and promoting cracking, thus facilitating its splitting into laths and park palings, we should remember that many woods in which it is hardly visible split much more readily than oak. The fracture, natural or artificial, does not indeed take place always at the cross-grain, although it is in its general direction, but it seems almost as if the cross-grain is harder in some respects, and by refusing to permit the line of fracture to traverse, it gives a sort of guidance to it. The natural cracks are really the result of greater shrinkage of outer rings over the inner rings, and they depend much upon the soil on which the tree has grown and its more or less seasoning, for if not cut in one of the ways which are known as "quartering," it may be expected to crack and twist. As regards the question of which is the ornamental and which the timber tree, I think we should reverse the position assigned in the paper to these species, for although straight-grown oak is valuable when otherwise of good quality, yet teak may be substituted for it, while there is no substitute for the curved oak, technically known as "compass" oak, which is used in shipbuilding and in Gothic roofs. The timber buyer looks out for strong curved hedge-row timber, especially if grown upon a clay soil. Oak grown in plantations, and such as is grown in Northamptonshire, Bucks, and Essex, all of which produce clean timber, of quick growth, is often called bastard oak, and is not valued for navy purposes. You must not mention the New Forest—the home of the "Durmast," or *sessiliflora* oak,—to a purchaser of ship timber. Surrey and Sussex especially, and parts of Hampshire and Kent are celebrated for good slow-growing wood, twisted and full of "flower." I value these practical opinions much more than any set of experiments I have seen in books, for it would be easy to get all the different results as to strength out of trees of the same species, grown on different soils, or even from different parts of the same log of timber.

The PRESIDENT then rose and said that no one could fail to observe the great difference between the two species in their marked characters when growing luxuriantly. From the fineness of its growth, the elegance of its branches, and the size and brighter green colour of its leaves, he thought there could be no question that the *sessiliflora* was the more ornamental tree. But if they visited situations in this county where oak trees grow in their greatest perfection—if they went over the ridge of Holm Lacy, or the

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hills of Stoke Edith and St. Devereux Park,—they would find the two species so closely connected by intermediate varieties, that it was impossible to say which was which, and which was not (laughter). For instance, at Holm Lacy there was every variety between that noble representative of *sessiliflora*, "the Monarch," and that interesting old "Trysting-tree," which was the largest of the *pedunculata* there. Nevertheless, when the forms of each kind were distinct, their different mode of growth could be recognised at sight, and greatly to the advantage of *sessiliflora*, he thought, as an ornamental tree. *Pedunculata* by no means always grew in the pollard form—the tallest and most perfect trunk at Holm Lacey was a *pedunculata*, and many others took the same growth. This depended more on the way the young trees were grown.

With reference to the rapidity of growth, his inquiries had led him to believe that *pedunculata* was the faster grower of the two. He then read passages from a letter he had received from Mr. Wells, of Holm Lacy, to prove this:—

"I am glad to see by the *Hereford Times* that my favourite oak has found an advocate in Mr. Key. Still, among so many conflicting statements brought forward, it is difficult to arrive at the truth. All the facts which I have proved for myself goes to show that *Q. Sessiliflora* is the slowest grower. In 1855 I sowed the two species—acorns gathered by myself—and at one year old I remarked that *Q. Pedunculata* was on an average 7 inches high; *Q. Sessiliflora* 4 inches high. At two years old *Q. Pedunculata* 24 inches, *Q. Sessiliflora* 10 inches, and this year the result is the same—seeds selected by myself and sown side by side. So much for the two species in their youth. Again in 1861 I selected two fine specimens, one of each sort, and have measured them yearly at the same height from the ground, the exact spot marked with gimlet holes in the bark, in which I put nails to guide the tape in making my yearly measurements.

Q. Pedunculata was in 1861—15ft. 1½in.	*Q. Sessiliflora* was in 1861—12ft. 10in.
,, ,, 1865—15ft. 6½in.	,, ,, 1865—13ft. 1in.

"Thus *Pedunculata* has grown 5 inches in circumference and *Sessiliflora* 3 inches. Again the result is against my *pet*, still there is a sturdiness about the seedlings of *Sessiliflora* which is very marked, and the roots are proportionally larger than *Pedunculata*, and when aged it is a much finer park tree, acquiring a deeper tint in Autumn. I consider the timber hard and brittle.

"Please observe that had I gathered the acorns indiscriminately and sown them mixed, *Sessiliflora* would have gone to the wall; and if any were not used, and many seedlings are constantly thrown away, it would have been the smaller ones. Again, *Sessiliflora* is not so fruitful: is not this *one* reason why the one sort is so scarce?

"S. WELLS."

Mr. Fraser, the forester at Stoke Edith, also writes:—

"I have read Mr. Key's paper, and must say that it is contrary to anything that I have seen, or heard, or read on the subject; he says, indeed, that practical men are mostly in favour of *Pedunculata*, which is true. One of the carpenters a short time ago was working a tree he had cut down in the park; the wood was of dark colour and coarse grain. He observed that it was not fit for post, or rail, or fence of any sort, as it would not last. I found it to be the *Sessiliflora*. The *robur* (as Sir J. Smith calls it) grows with long slender shoots, is finer in the grain and much tougher, and will last much longer out of doors; so say the carpenters, and I think with truth. But there are a great many varieties of oaks. I went to Devereux Pool and find the large one there, a *Hybrid*, rather inclining to *Sessiliflora*, but not without a *peduncle*, but one of them, measured in a field near Park farm, is decidedly *Sessiliflora*, having no stalk at all. I have examined a number of the largest oaks in the park and find that no two of them are exactly alike, but the tallest and finest of them are *Pedunculata*. The soil and situation has more to do with the size and growth of the oak than the variety, for I think they are only such after all, and I see Babington is of the same opinion. I sowed a quantity of acorns some years ago, and found great varieties among them, although all were from the same tree.

"G. FRASER."

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There was no doubt, the President added, that in the trade, timber dealers did not inquire which oak it was, but put their value upon it according to the grain, and not according to the kind; and in the market *pedunculata* was certainly everywhere the most valuable. Carpenters preferred Riga and *sessiliflora* oak, because it works easier, and they argued that, if taken care of, it would wear as well as *pedunculata*. They could give no reason why the latter commanded a much better price, but a general belief existed as to its much greater durability.

R. D. HARRISON, Esq., said that *sessiliflora* was common in the north of England, where oaks were famous for their large size; but as to durability of oak, he contended that did not depend so much upon the kind as upon the quality of the soil where it grew, and adduced local instances in proof of this.

The Rev. H. KEY doubted whether one of Mr. Blashill's specimens was *pedunculata*, as he alleged.

Mr. BLASHILL contended that it was, and said that none of our Government timber buyers would think of buying *sessiliflora*.

The Rev. H. C. KEY, in a brief reply, stated that he could not agree with many of the observations made by the several speakers. Against the authorities they had quoted, he was content to have Dr. Lindley, Sir Wm. Hooker, and the others named in his paper, to the effect that *sessiliflora* is as superior in the quality of its timber as it is in the beauty of its growth. None of them had met the fact that *sessiliflora* produced a far greater quantity of timber, from growing with a longer trunk, and rarely taking the pollard form which distinguishes *pedunculata*. And notwithstanding the scarcity of *sessiliflora* in the county, which probably does not amount to more than four per cent. of the oak trees, if anyone asks which are the finest specimens of oak in this county, he would be told that there are two which stand pre-eminent, viz., the great oak at Tibberton (probably the finest oak in all England), and "the Monarch" at Holm Lacey. These two trees are *quercus sessiliflora*.

The PRESIDENT, in closing the discussion, repeated his opinion as to the greater beauty of *sessiliflora*, and added that if they consulted a timber merchant, he would say that oak grown in a particular district was always excellent, but that he would not value oak grown in another district that experience had told him was unfitted to produce it. The timber merchant therefore formed his estimate of value according to its quality, and knew nothing of the difference between *sessiliflora* and *pedunculata*. Looking at all the statements which had been put forward he thought they must admit that when well grown the *sessiliflora* was the more ornamental tree, but that they could not go further. Everything beyond that depended upon the quality of the wood itself, its rate of growth, and the soil on which it grew.

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[For the Retiring Address of the President, see back page 146.]

The time for the departure of the evening trains having arrived, the proceedings terminated.

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WOOLHOPE NATURALISTS' FIELD CLUB.

Statement of Accounts for the Year ending December 31st, 1866.

Dr.	£	s.	d.	Cr.	£	s.	d.
Balance in National Provincial Bank ...	15	12	8	Hereford Savings Bank	10	0	0
Treasurer's Balance	3	17	0	Assistant Secretary	5	0	0
Subscriptions for 1862	1	0	0	Printing Transactions No. 6 (Head) ...	4	16	0
„ 1863	3	10	0	„ Summary of Flora (Phillips) ...	15	0	0
„ 1864	7	0	0	„ Reports of Field Meeting (Anthony)	10	13	6
„ 1865	18	0	0	„ Notices, Stationery, &c. (Phillips)	13	12	0
„ 1866	26	10	0	Balance in National Provincial Bank ...	15	7	8
				Treasurer's Balance	1	0	6
	£75	9	8		£75	9	8

Deposited in the Hereford Savings Bank, with the interest to December 31st, 1866, £70 16s. 9d.

Examined and found correct,

ARTHUR THOMPSON, Treasurer.

HENRY G. BULL, President.

C. G. MARTIN, Vice-President.

Hereford, February 4th, 1867.

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WOOLHOPE NATURALISTS' FIELD CLUB.

OFFICERS FOR THE YEAR 1867.

PRESIDENT:

CHANDOS WREN HOSKYNS, Esq., Harewood, Ross.

VICE-PRESIDENTS:

The Rev. SAMUEL CLARK, M.A.—for the Colwall Meeting.

The Rev. THOS. WOODHOUSE, M.A. „ Llandrindod „

HUMPHREY SALWEY, Esq. ..... „ Ludlow „

TIMOTHY CURLEY, Esq., C.E., F.G.S. „ Woolhope „

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FIELD MEETINGS APPOINTED.

1867.

TUESDAY, MAY 28th.....	Colwall for the Herefordshire Beacon.
FRIDAY, JUNE 28th	Llandrindod.
(Day to be fixed by Central Committee).....	Ludlow.
TUESDAY, AUGUST 27th	Hereford for Woolhope.

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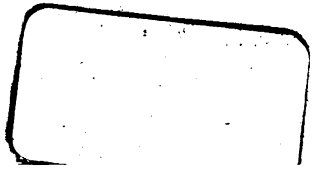

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